STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 1st Semester (COMMON TO ALL ENGINEERING COURSES)(wef 2018-19)

Subject Code	Subject	Periods/week			Evaluation Scheme			
		L	T	P	Mid Sem Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
	Theory							
Th.1a Th.1b	Communicative English **OR** Computer Application	4	-	-	20	80	3	100
Th.2a Th.2b	Engineering Physics **OR** Enggineering Chemistry	4	-	-	20	80	3	100
Th.3	Engineering Mathematics-I	5	1	-	20	80	3	100
Th.4 Th.4a&b	Engg. Mechanics **OR** Basic Electrical & Electronics Engg.	4			20	80	3	100
	Total	17	-		80	320	-	400
	Practical							
Pr.1a Pr.1b	Comm. English Lab **OR** Computer application Lab	-	-	4	50	-	-	50
Pr.2a Pr.2b	Engg. Physics Lab **OR** Engg. Chemistry Lab	-	-	4	50	50	3	100
Pr.3a Pr.3b	Engineering Drawing **OR** Workshop Practice	-	-	6	50	100	3 4	150
Pr.4	Seminar			4	50			50
	Student Centred Activities(SCA)		-	3	-	-	-	-
	Total	-	-	21	*200*	*150*	-	*350*
	Grand Total	**17**	**1**	**21**	**280**	**470**	**-**	**750**
	Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration							
	Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%							
	SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies etc. Seminar and SCA shall be conducted in a section.							
	There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester							
	In Th.4a&b Basic Electrical & Electronics Engg. paper there shall be examination in separate Answer books for Th.4a Basic Electrical Engg. and Th.4b Basic Elecronics Engg. in the same sitting							

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 2nd Semester (COMMON TO ALL ENGINEERING COURSES)(wef 2018-19)

Subject Code	Subject	Periods/week			Evaluation Scheme			
		L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
	Theory							
Th.1a Th.1b	Communicative English **OR** Computer Application	4	-	-	20	80	3	100
Th.2a Th.2b	Engineering Physics **OR** Enggineering Chemistry	4	-	-	20	80	3	100
Th.3	Engineering Mathematics-II	5	1	-	20	80	3	100
Th.4 Th.4a&b	Engg. Mechanics **OR** Basic Electrical & Electronics Engg.	4			20	80	3	100
	Total	*17*	*1*		*80*	*320*	*-*	*400*
	Practical							
Pr.1a Pr.1b	Comm. English Lab **OR** Computer application Lab	-	-	4	50	-	-	50
Pr.2a Pr.2b	Engg. Physics Lab **OR** Engg. Chemistry Lab	-	-	4	50	50	3	100
Pr.3a Pr.3b	Engineering Drawing **OR** Workshop Practice	-	-	6	50	100	3 4	150
Pr.4	Seminar			4	50			50
	Student Centred Activities(SCA)		-	3	-	-	-	-
	Total	*-*	*-*	*21*	*200*	*150*	*-*	*350*
	Grand Total	**17**	**1**	**21**	**280**	**470**	**-**	**750**

Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration

Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%

SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies etc. Seminar and SCA shall be conducted in a section.

There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester
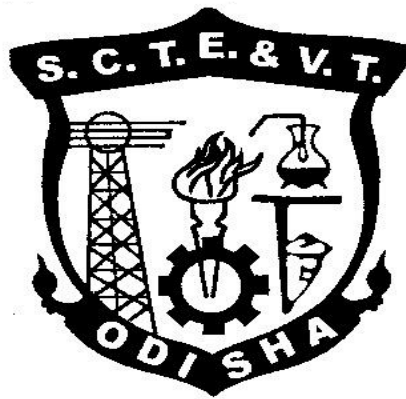
In Th.4a&b Basic Electrical & Electronics Engg. paper there shall be examination in separate Answer books for Th.4a Basic Electrical Engg. and Th.4b Basic Eleconics Engg. in the same sitting

CURRICULLUM OF 1ST & 2ND SEMESTER

For

DIPLOMA IN ENGINEERING

(Effective FROM 2018-19 Session)

STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING, ODISHA, BHUBANESWAR

Th.1a.   COMMUNICATIVE ENGLISH
(1st & 2nd sem Common)

Theory: 4 Periods per Week	I.A : 20 Marks
Total Periods: 60 Periods	Term End Exam : 80 Marks
Examination: 3 Hours	TOTAL MARKS : 100 Marks

Topic- wise distribution of periods with marks

S.L. No.	Topics	Periods
I	Literature Appreciation	20
II	Vocabulary	05
III	Application of Grammar	08
IV	Formal writing skills	15
V	Elements of communication	12
	• Introduction to communication	
	• Professional communication	
	• Nonverbal communication	
	Total	60

OBJECTIVE

To comprehend the given passage

To answer correctly the questions on seen and unseen passages

To increase the vocabulary

To apply rules of grammar for flawless writing

To understand and use the basic concepts of communication in an organized set up and social context

To give a positive feedback in various situation, to use appropriate body language and to avoid barrier for effective communication

To improve writing skill

Unit-I
LITERATURE APPRECIATION
1. Reading comprehension

Sub-skills of reading comprehension are to be worked out and tested through an unseen passage in about 200-500 words.
A student should get acquainted with sub-skills of reading for the purpose of:
- Skimming the gist
- Scanning for necessary information
- Close reading for inference and evaluation
- Main idea and supporting points
- Guessing the meaning of un-familiar words
- Note- making
- Summarizing
- Supplying a suitable title

2. Text
The following chapter from **"Invitation to English", Book-1** for +2 students of CHSE, Odisha.**2016 reprint** to be covered in class room:

- **Standing Up For Yourself** By Yevgeny Yevtushenko

- **The Magic Of Teamwork** By Sam Pitroda
- **Inchcape Rock** By Robert Southey
- **To My True Friend** By Elizabeth Pinard

The student is to answer comprehension questions from these chapters in the end examination.
UNIT- II
VOCABULARY
Use of synonyms, antonyms
- Same word used in different situations in different meaning
- Single word substitute

Unit-III
APPLICATION OF ENGLISH GRAMMAR
- Countable an Uncountable Noun
- Articles and Determiners
- Modal Verbs
- Tenses
- Voice-change
- Subject-verb Agreement

UNIT-IV
FORMAL WRITING SKILLS

1. Paragraph writing
   - Meaning
   - Features of Paragraph Writing (Topic Statement, Supporting Points and Plot Compatibility)
   - Developing Ideas into Paragraphs **(** Describing Place/ Person/ Object /Situation and any general topic of interest)
2. Notice
3. Agenda
4. Report writing (Format of a Report, Reporting an event / news)
5. Writing personal letter
6. Letter to the Principal, Librarian, Head of the Deptt, and Hostel Superintendent
7. Writing Business letters
   - Layout of a Business Letter
   - Letter of Enquiry, Placing an Order, Execution of an Order, Complaint, Cancellation of an order(Features, Format and example)
8. Job application and C.V.(Features, Format and example)

UNIT-V
ELEMENTS OF COMMUNICATION
A. Introduction to Communication
1. Meaning, Definition and concept of communication
2. Good Communication and Bad Communication
3. Communication model
   - One-way Communication Model and Two-way Communication Model with examples
4. Process of communication and factors responsible for it
   - Sender, Message, Channel, Receiver / Audience, Feedback, Noise, Context

B. Professional Communication
1. Meaning of professional communication
2. Types of professional communication
   2.1. Formal or Systematic Communication
   - Upward communication (How it takes place, symbol, merits and demerits)
   - Down-ward communication (How it takes place, symbol, merits and demerits)

- Parallel communication (How it takes place, symbol, merits and demerits)
2.2. Informal communication
- Grape vine communication (How it takes place, symbol, merits and demerits)

D. Non- Verbal Communication
1. Meaning of nonverbal Communication
2. Different areas of Non-verbal Communication
- Kinesics or Body Language (Postures and Gestures, Facial Expression and Eye Contact)
- Proxemics or Spatial Language (Private Space, Personal Space, Social Space, Public Space)
- Language of Signs and Symbols(Audio Sign and Visual Sign in everyday life with merits and demerits)

<u>**Syllabus Coverage up to I.A**</u>

1. Reading Comprehension
2. Standing Up by Yourself
3. Use of Synonyms and Antonyms
4. Notice
5. Agenda

Books Recommended:

Invitation to English, Book-1, (for +2 students), CSHE (2016 reprint), Odisha
Invitation to English, Book-2, (for +2 students), CSHE (2016 reprint), Odisha
Invitation to English, Book-3, (for +2 students), CSHE (2016 reprint), Odisha
Invitation to English, Book-4, (for +2 students), CSHE (2016 reprint), Odisha
Wren and Martin High School English Grammar, Dr. NDV Prasad Rao, S. Chand Publication
Communication Skills, Sanjay Kumar and Puspalata, Oxford University Press

Th.1b. COMPUTER APPLICATION
(1st / 2nd sem Common)

Theory: 4 Periods per Week

Total Periods: 60 Periods

Examination: 3 Hours

I.A : 20 Marks

End Sem Exam : 80 Marks

TOTAL MARKS : 100 Marks

Objective:

The students will get to know about the fundamentals of computer. They will get acquainted with various components of computer hardware, software etc. Idea on Role of operating system and its usability will also be known. Knowledge on word processing, electronic spreadsheet, presentation software and Internet will also be acquired. The students will be given brief knowledge about Programming methodology and C programming.

Topic wise distribution of periods

Sl. No.	Topics	Periods
1	Computer Organisation	05
2	Computer Software	07
3	Computer Network and Internet	08
4	File Management and Data Processing	05
5	Problem Solving Methodology	05
6	Overview of C Programming language	15
7	Advanced features of C	15
	TOTAL	**60**

1. **COMPUTER ORGANISATION**

   Introduction to Computer Evolution of Computers Generation of Computers Classification of Computers

   Basic Organisation of Computer (Functional Block diagram) Input Devices, CPU & Output Devices.

   Computer Memory and Classification of Memory

2. **COMPUTER SOFTWARE**

   Software concept, System software, Application software

   Overview of Operating System Objectives and Functions of O.S ,

   Types of Operating System: Batch Processing, Multiprogramming, Time Sharing OS

   Features of DOS, Windows and UNIX

   Programming Languages Compiler, interpreter Computer Virus

   Different Types of computer virus

   Detection and prevention of Virus

   Application of computers in different Domain

3. **COMPUTER NETWORK AND INTERNET**

   Networking concept, Protocol, Connecting Media, Date Transmission mode

   Network Topologies, Types of Network

   Networking Devices like Hub, Repeater, Switch, Bridge, Router, Gateway & NIC

   Internet Services like E-Mail, WWW, FTP, Chatting, Internet Conferencing, Electronic Newspaper & Online Shopping

   Different types of Internet connectivity and ISP

4.   FILE MANAGEMENT AND DATA PROCESSING
Concept of File and Folder
File Access and Storage methods. Sequential, Direct, ISAM
Data Capture, Data storage
Data Processing and Retrieval

5.   PROBLEM SOLVING METHODOLOGY
Algorithm, Pseudo code and Flowchart Generation of Programming Languages
Structured Programming Language
Examples of Problem solving through Flowchart

6.   OVERVIEW OF C PROGRAMMING LANGUAGE
Constants, Variables and Data types in C Managing Input and Output operations.
Operators, Expressions, Type conversion & Typecasting
Decision Control and Looping Statements (If, If-else, If-else-if, Switch, While, Do-while, For, Break, Continue & Goto)
Programming Assignments using the above features.

7.   ADVANCED FEATURES OF C
Functions and Passing Parameters to the Function (Call by Value and Call by
Reference) Scope of Variables and Storage Classes
Recursion Function and Types of Recursion
One Dimensional Array and Multidimensional Array
String Operations and Pointers
Pointer Expression and Pointer Arithmetic Programming Assignments using the above features. Structure and Union (Only concepts, No Programming)

Syllabus coverage upto I.A
Chapter- 1,2 3,4

Books Recommended
1.   Computer Fundamentals and Programming in C by Reema Thareja, Oxford Unversity Press
2.   Programming in ANSI C by A.N Kamthane, Pearson Education
3.   Computer Application by Kalyani Publisher
4.   Let us C by Y. Kanetkar, BPB
5.   Computer Fundamentals, by E. Balaguruswamy, TMH

Th.2a. Engineering Physics
(1st / 2nd sem Common)

Theory: 4 Periods per Week
Total Periods: 60 Periods
Examination: 3 Hours

I.A: 20 Marks
End Sem Exam :   80 Marks
TOTAL MARKS : 100 Marks

Unit	Topic	No. of periods
1	UNITS & DIMENSIONS	03
2	SCALARS & VECTORS	03
3	KINEMATICS	06
4	WORK & FRICTION	05
5	GRAVITATION	05
6	OSCILLATIONS & WAVES	06
7	HEAT & THERMODYNAMICS	07
8	OPTICS	04
9	ELECTROSTATICS & MAGNETOSTATICS	07
10	CURRENT ELECTRICITY	06
11	ELECTROMAGNETISM & ELECTROMAGNETIC INDUCTION	05
12	MODERN PHYSICS	03
	TOTAL :	60 Periods

UNIT 1 - UNITS AND DIMENSIONS

1.1   Physical quantities - (Definition).
1.2   Definition of fundamental and derived units, systems of units (FPS, CGS, MKS and SI units).
1.3   Definition of dimension and Dimensional formulae of physical quantities.
1.4   Dimensional equations and Principle of homogeneity.
1.5   Checking the dimensional correctness of Physical relations.

UNIT 2 - SCALARS AND VECTORS

2.1   Scalar and Vector quantities (definition and concept), Representation of a Vector – examples, types of vectors.
2.2   Triangle and Parallelogram law of vector Addition (Statement only). Simple Numerical.
2.3   Resolution of Vectors – Simple Numericals on Horizontal and Vertical components.
2.4   Vector multiplication (scalar product and vector product of vectors).

UNIT 3 - KINEMATICS

3.1   Concept of Rest and Motion.
3.2   Displacement, Speed, Velocity, Acceleration & FORCE (Definition, formula, dimension & SI units).
3.3   Equations of Motion under Gravity (upward and downward motion) - no derivation.
3.4   Circular motion: Angular displacement, Angular velocity and Angular acceleration (definition, formula & SI units).
3.5   Relation between –(i) Linear & Angular velocity, (ii) Linear & Angular acceleration).
3.6   Define Projectile, Examples of Projectile.
3.7   Expression for Equation of Trajectory, Time of Flight, Maximum Height and Horizontal Range for a projectile fired at an angle, Condition for maximum Horizontal Range.

UNIT 4 – WORK AND FRICTION

4.1   Work – Definition, Formula & SI units.
4.2   Friction – Definition & Concept.
4.3   Types of friction (static, dynamic), Limiting Friction (Definition with Concept).
4.4   Laws of Limiting Friction (Only statement, No Experimental Verification).
4.5   Coefficient of Friction – Definition & Formula, Simple Numericals.
4.6   Methods to reduce friction.

UNIT 5 - GRAVITATION

5.1   Newton's Laws of Gravitation – Statement and Explanation.
5.2   Universal Gravitational Constant (G)- Definition, Unit and Dimension.
5.3   Acceleration due to gravity (g)- Definition and Concept.

5.4   Definition of mass and weight.
5.5   Relation between g and G.
5.6   Variation of g with altitude and depth (No derivation – Only Explanation).
5.7   Kepler's Laws of Planetary Motion (Statement only).

UNIT 6 - OSCILLATIONS AND WAVES

6.1   Simple Harmonic Motion (SHM) - Definition & Examples.
6.2   Expression (Formula/Equation) for displacement, velocity, acceleration of a body/ particle in SHM.
6.3.   Wave motion – Definition & Concept.
6.4   Transverse and Longitudinal wave motion – Definition, Examples & Comparison.
6.5   Definition of different wave parameters (Amplitude, Wavelength, Frequency, Time Period.
6.6   Derivation of Relation between Velocity, Frequency and Wavelength of a wave
6.7   Ultrasonics – Definition, Properties & Applications.

UNIT 7 - HEAT AND THERMODYNAMICS

7.1   Heat and Temperature – Definition & Difference
7.2   Units of Heat (FPS, CGS, MKS & SI).
7.3   Specific Heat (concept, definition, unit, dimension and simple numerical)
7.4   Change of state (concept), Latent Heat (concept, definition, unit, dimension and simple numerical)
7.5   Thermal Expansion – Definition & Concept
7.6   Expansion of Solids (Concept)
7.7   Coefficient of linear, superficial and cubical expansions of Solids – Definition & Units.
7.8   Relation between α, β & Υ
7.9   Work and Heat - Concept & Relation.
7.10   Joule's Mechanical Equivalent of Heat (Definition, Unit)
7.11   First Law of Thermodynamics (Statement and concept only)

UNIT 8 – OPTICS

8.1   Reflection & Refraction – Definition.
8.2   Laws of reflection and refraction (Statement only)
8.3   Refractive index – Definition, Formula &Simple numerical.
8.4   Critical Angle and Total internal reflection – Concept, Definition & Explanation
8.5   Refraction through Prism (Ray Diagram & Formula only – NO derivation)..
8.6   Fiber Optics – Definition, Properties & Applications.

UNIT 9 – ELECTROSTATICS & MAGNETOSTATICS

9.1   Electrostatics – Definition & Concept.
9.2   Statement & Explanation of Coulombs laws, Definition of Unit charge.
9.3   Absolute & Relative Permittivity (ε) – Definition, Relation & Unit.

9.4   Electric potential and Electric Potential difference (Definition, Formula & SI Units).
9.5   Electric field, Electric field intensity (E) – Definition, Formula & Unit.
9.6   Capacitance - Definition, Formula & Unit.
9.7   Series and Parallel combination of Capacitors (No derivation, Formula for effective/Combined/total capacitance & Simple numericals).
9.8   Magnet, Properties of a magnet.
9.9   Coulomb's Laws in Magnetism – Statement & Explanation, Unit Pole (Definition).
9.10   Magnetic field, Magnetic Field intensity (H) - (Definition, Formula & SI Unit).
9.11   Magnetic lines of force (Definition and Properties)
9.12   Magnetic Flux (Φ) & Magnetic Flux Density (B) – Definition, Formula & Unit.

UNIT 10 – CURRENT ELECTRICITY

10.1   Electric Current – Definition, Formula & SI Units.
10.2   Ohm's law and its applications.
10.3   Series and Parallel combination of resistors (No derivation, Formula for effective/ Combined/ total resistance & Simple numericals).
10.4   Kirchhoff's laws (Statement & Explanation with diagram).
10.5   Application of Kirchhoff's laws to Wheatstone bridge - Balanced condition of Wheatstone's Bridge – Condition of Balance (Equation).

UNIT 11 – ELECTROMAGNETISM & ELECTROMAGNETIC INDUCTION

11.1 Electromagnetism – Definition & Concept.
11.2 Force acting on a current carrying conductor placed in a uniform
          magnetic   field, Fleming's Left Hand   Rule
11.3 Faraday's Laws of Electromagnetic Induction (Statement only)
11.4 Lenz's Law (Statement)
11.5 Fleming's Right Hand Rule
11.6 Comparison between Fleming's Right Hand Rule and Fleming's
          Left Hand Rule.

UNIT 12 - MODERN PHYSICS

12.1   LASER & laser beam (Concept and Definition)
12.2   Principle of LASER (Population Inversion & Optical Pumping)
12.3   Properties & Applications of LASER
12.4   Wireless Transmission – Ground Waves, Sky Waves, Space Waves
                  (Concept & Definition)

RECOMMENDED BOOKS

1. Text Book of Physics for Class XI (Part-I, Part-II) N.C.E.R.T
2. Text Book of Physics for Class XII (Part-I, Part-II) N.C.E.R.T
3. Text Book of Engineering Physics by Barik, Das, Sharma, Kalyani Publisher
4. Concepts in Physics by H. C. Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi

Syllabus coverage upto I.A

Units 1,2,3,4,5,6

Th.2b. Engineering Chemistry
(1ˢᵗ / 2ⁿᵈ sem Common)

Theory: 4 Periods per Week   I.A : 20 Marks
Total Periods: 60 Periods   Term End Exam : 80 Marks
Examination: 3 Hours   TOTAL MARKS : 100 Marks

Objective:
Engineering Chemistry is concerned with the changes of matters with its environment and an ever
growing subject. So, the aim of teaching Engineering Chemistry in Diploma Courses is to acquaint
the students with the basic Chemistry of different materials used in industry and to equip the
students with the basic principles of chemical changes taking place in different aspects connected
to engineering fields. They also develop the right attitude to cope up with the continuous flow of
new technology.

Topic wise distribution of periods

Sl. No	Topics/ Units	Periods
A	Physical Chemistry	22
B	Inorganic Chemistry	08
C	Organic Chemistry	10
D	Industrial Chemistry	20
	TOTAL	**60**

A. <u>PHYSICAL CHEMISTRY</u>

Chapter 1: Atomic structure : Fundamental particles (electron, proton & neutron Definition, mass and charge).Rutherford's Atomic model (postulates and failure), Atomic mass and mass number, Definition, examples and properties of Isotopes, isobars and isotones. Bohr's Atomic model (Postulates only), Bohr-Bury scheme, Aufbau's principle, Hund's rule, Electronic configuration (up to atomic no 30).

Chapter 2 : Chemical Bonding : Definition , types (Electrovalent, Covalent and Coordinate bond with examples (formation of $NaCl$, $MgCl_2$, H_2,Cl_2, O_2, N_2, H_2O, CH_4, NH_3, NH_4^+, SO_2).

Chapter 3 : Acid base theory : Concept of Arrhenius, Lowry Bronsted and Lewis theory for acid and base with examples (Postulates and limitations only). Neutralization of acid & base. Definition of Salt, Types of salts (Normal, acidic, basic, double, complex and mixed salts, definitions with 2 examples from each).

Chapter 4: Solutions : Definitions of atomic weight, molecular weight, Equivalent weight. Determination of equivalent weight of Acid, Base and Salt.
Modes of expression of the concentrations (Molarity , Normality & Molality) with Simple Problems. pH of solution (definition with simple numericals)
Importance of pH in industry (sugar, textile, paper industries only)

Chapter 5 : Electrochemistry : Definition and types (Strong & weak) of Electrolytes with example. Electrolysis (Principle & process) with example of NaCl (fused and aqueous solution).
Faraday's 1st and 2ⁿᵈ law of Electrolysis (Statement, mathematical expression and Simple numerical) Industrial application of Electrolysis- Electroplating (Zinc only).

Chapter 6 : Corrosion: Definition of Corrosion, Types of Corrosion- Atmospheric Corrosion, Waterline corrosion. Mechanism of rusting of Iron only. Protection from Corrosion by (i) Alloying and (ii) Galvanization.

B. INORGANIC CHEMISTRY

Chapter 7 : Metallurgy: Definition of Mineral, ores , gangue with example. Distinction between Ores And Minerals. General methods of extraction of metals,

- i) Ore Dressing
- ii) Concentration (Gravity separation, magnetic separation, Froth floatation & leaching)
- iii) Oxidation (Calcinations, Roasting)
- iv) Reduction (Smelting, Definition & examples of flux, slag)
- v) Refining of the metal (Electro refining, & Distillation only)

Chapter 8 : Alloys: Definition of alloy. Types of alloys (Ferro, Non Ferro & Amalgam) with example. Composition and uses of Brass, Bronze, Alnico, Duralumin

C. ORGANIC CHEMISTRY

Chapter 9 : Hydrocarbons : Saturated and Unsaturated Hydrocarbons (Definition with example)
Aliphatic and Aromatic Hydrocarbons (Huckle's rule only). Difference between Aliphatic and aromatic hydrocarbons
 IUPAC system of nomenclature of Alkane, Alkene, Alkyne, alkyl halide and alcohol (up to 6 carbons) with bond line notation.
Uses of some common aromatic compounds (Benzene, Toluene, BHC, Phenol, Naphthalene, Anthracene and Benzoic acid) in daily life.

D. INDUSTRIAL CHEMISTRY

Chapter 10 : **Water Treatment** : Sources of water, Soft water, Hard water, hardness, types of Hardness (temporary or carbonate and permanent or non-carbonate), Removal of hardness by lime soda method (hot lime & cold lime—Principle, process & advantages) , Advantages of Hot lime over cold lime process.
Organic Ion exchange method (principle, process, and regeneration of exhausted resins)
 Chapter 11 : Lubricants: Definition of lubricant, Types (solid, liquid and semisolid with examples only) and specific uses of lubricants (Graphite, Oils, Grease), Purpose of lubrication
Chapter 12 : Fuel: Definition and classification of fuel, Definition of calorific value of fuel, Choice of good fuel.
Liquid: Diesel, Petrol, and Kerosene --- Composition and uses.
Gaseous: Producer gas and Water gas (Composition and uses). Elementary idea about LPG, CNG and coal gas (Composition and uses only).

Chapter 13 : Polymer: Definition of Monomer, Polymer, Homo-polymer, Co-polymer and Degree of polymerization. Difference between Thermosetting and Thermoplastic, Composition and uses of Polythene, & Poly-Vinyl Chloride and Bakelite.
Definition of Elastomer (Rubber). Natural Rubber (it's draw backs). Vulcanisation of Rubber. Advantages of Vulcanised rubber over raw rubber.

Chapter 14: Chemicals in Agriculture: Pesticides: Insecticides, herbicides, fungicides- Examples and uses.
Bio Fertilizers: Definition, examples and uses.

Syllabus Coverage upto I.A

Chapter 1,2,3,4,5,6

Books Recommended

1. Text Book of Intermediate Chemistry Part-1 and Part-2 by Nanda, Das, Sharma, Kalyani Publishers
2. Engg. Chemistry by B.K. Sharma, Krishna Prakashan Media Pvt. Ltd
3. Engineering Chemistry by Y.R. Sharma and P. Mitra, Kalyani Publishers
4. Engineering Chemistry for Diploma – Dr. R K Mohapatra, PHI Publication, New Delhi.
5. Engineering Chemistry- Jain & Jain, Dhanpat Roy and Sons.

Th.3. ENGINEERING MATHEMATICS-I
(1ST Sem Common)

Theory: 5 Periods per Week   I.A : 20 Marks
Total Periods: 75 Periods   End Sem Exam : 80 Marks
Examination: 3 Hours   TOTAL MARKS : 100 Marks

OBJECTIVE:
1. This subject helps the students to develop logical thinking which is useful in comprehending the principles of all to the subjects.
2. Analytical and systematic approach towards any problem is developed through learning of this subject.
3. Mathematics being a versatile subject can be used at every stage of human life.

Topic wise distribution of periods and marks

SI. No.	Subject	Unit	Topic	Periods
A	Algebra	1	Matrices and Determinant	18
B	Trigonometry	2	Trigonometry	15
C	Two Dimensional Geometry	3	Co-ordinate Geometry in Two Dimensions (Straight Line)	13
		4	Circle	07
D	Three Dimensional Geometry	5	Co-ordinate Geometry in Three Dimensions	15
		6	Sphere	07
			TOTAL	**75**

1) MATRICES AND DETERMINANTS
  a) Types of matrices
  b) Algebra of matrices
  c) Determinant
  d) Properties of determinant
  e) Inverse of a matrix (second and third order)
      (Question should be on second order matrix)
  f) Cramer's Rule (Question should be on two variables)
  g) Solution of simultaneous equations by matrix inverse method
      (Question should be on two variables)
2) TRIGONOMETRY
  a) Trigonometrical ratios
  b) Compound angles, multiple and sub-multiple angles (only formulae)
  c) Define inverse circular functions and its properties (no derivation)
3) CO-ORDINATE GEOMETRY IN TWO DIMENSIONS   (Straight line)
  a) Introduction of geometry in two dimension
  b) Distance formulae, division formulae, area of a triangle (only formulae no derivation)
  c) Define slope of a line, angle between two lines (only F),
  condition of perpendicularity and parallelism.
  d) Different forms of straight lines (only formulae)
    i) One point form (ii) two point form (iii) slope form (iv) intercept form
    (v) Perpendicular form
  e) Equation of a line passing through a point and (i) parallel to a line
    (ii) Perpendicular to a line
  f) Equation of a line passing through the intersection of two lines
  g) Distance of a point from a line
4) CIRCLE

a) Equation of a circle
  (i) center radius form
  (ii) general equation of a circle
  (iii) end point of diameter form

5) CO-ORDINATE GEOMETRY IN THREE DIMENSIONS

a) Distance formulae, section formulae, direction ratio, direction cosine, angle between two lines (condition of parallelism and perpendicularity)

b) Equation of a plane

i) General form, angle between two planes, perpendicular distance of a point from a plane, equation of a plane passing through a point and

i) parallel to a plane (ii) perpendicular to a plane

6) SPHERE

a) Equation of a sphere
  i) center radius form
  ii) general form
  iii) two end points of a diameter form (only formulae and problems)

Books Recommended:

1. Elements of Mathematics _ Vol. _ 1 & 2 (Odisha State Bureau of Text Book preparation & Production)

Reference Books:

1. Mathematics Part- I & Part- II- Textbook for Class XII, NCERT Publication

Syllabus to be covered up to IA

Ch.1, Ch,2, and Ch,3,(a,b,c)

Th. 4. ENGINEERING MECHANICS
(2nd sem Common)

Theory: 4 Periods per Week   I.A : 20 Marks
Total Periods: 60 Periods   End Sem Exam : 80 Marks
Examination: 3 Hours   TOTAL MARKS : 100 Marks

Objective:

On completion of the subject, the student will be able to do:

1. Compute the force, moment & their application through solving of simple problems on coplanar forces.
2. Understand the concept of equilibrium of rigid bodies.
3. Know the existence of friction & its applications through solution of problems on above.
4. Locate the C.G. & find M.I. of different geometrical figures.
5. Know the application of simple lifting machines.
6. Understand the principles of dynamics.

Topic wise distribution of periods

Sl. No.	Topics	Periods
1	Fundamentals of Engineering Mechanics	14
2	Equilibrium	08
3	Friction	10
4	Centroid & moment of Inertia	14
5	Simple Machines	08
6	Dynamics	06
	TOTAL	**60**

1. **FUNDAMENTALS OF ENGINEERING MECHANICS**

    1.1 Fundamentals.

    Definitions of Mechanics, Statics, Dynamics, Rigid Bodies,

    1.2 Force
    Force System.

    Definition, Classification of force system according to plane & line of action.

    Characteristics of Force & effect of Force. Principles of Transmissibility & Principles of Superposition. Action & Reaction Forces & concept of Free Body Diagram.

    1.3 Resolution of a Force.

    Definition, Method of Resolution, Types of Component forces, Perpendicular components & non-perpendicular components.

    1.4 Composition of Forces.

    Definition, Resultant Force, Method of composition of forces, such as

    1.4.1 Analytical Method such as Law of Parallelogram of forces & method of resolution.

    1.4.2. Graphical Method.

    Introduction, Space diagram, Vector diagram, Polygon law of forces.

    1.4.3 Resultant of concurrent, non-concurrent & parallel force system by Analytical & Graphical Method.

    1.5 Moment of Force.
    Definition, Geometrical meaning of moment of a force, measurement of moment of a force & its S.I units. Classification of moments according to

direction of rotation, sign convention, Law of moments, Varignon's Theorem, Couple – Definition, S.I. units, measurement of couple, properties of couple.

2. EQUILIBRIUM

2.1 Definition, condition of equilibrium, Analytical & Graphical conditions of equilibrium for concurrent, non-concurrent & Free Body Diagram.

2.2 Lamia's Theorem – Statement, Application for solving various engineering problems.

3. FRICTION

3.1 Definition of friction, Frictional forces, Limiting frictional force, Coefficient of Friction.
Angle of Friction & Repose, Laws of Friction, Advantages & Disadvantages of Friction.

3.2 Equilibrium of bodies on level plane – Force applied on horizontal & inclined plane (up &down).

3.3 Ladder, Wedge Friction.

4. CENTROID & MOMENT OF INERTIA

4.1 Centroid – Definition, Moment of an area about an axis, centroid of geometrical figures such as squares, rectangles, triangles, circles, semicircles & quarter circles, centroid of composite figures.

4.2 Moment of Inertia – Definition, Parallel axis & Perpendicular axis Theorems. M.I. of plane lamina & different engineering sections.

5. SIMPLE MACHINES

5.1 Definition of simple machine, velocity ratio of simple and compound gear train, explain simple & compound lifting machine, define M.A, V.R. & Efficiency & State the relation between them, State Law of Machine, Reversibility of Machine, Self Locking Machine.

5.2 Study of simple machines – simple axle & wheel, single purchase crab winch & double purchase crab winch, Worm & Worm Wheel, Screw Jack.

5.3 Types of hoisting machine like derricks etc, Their use and working principle. No problems.

6. DYNAMICS

6.1 Kinematics & Kinetics, Principles of Dynamics, Newton's Laws of Motion, Motion of Particle acted upon by a constant force, Equations of motion, De-Alembert's Principle.

6.2 Work, Power, Energy & its Engineering Applications, Kinetic & Potential energy & its application.

6.3 Momentum & impulse, conservation of energy & linear momentum, collision of elastic bodies, and Coefficient of Restitution.

Syllabus coverage upto I.A
Chapter 1, 2 and 3.1

Books Recommended
1. Engineering Mechanics – by A.R. Basu (TMH Publication Delhi)
2. Engineering Machines – Basudev Bhattacharya (Oxford University Press).
3. Text Book of Engineering Mechanics – R.S Khurmi (S. Chand).
4. Applied Mechanics & Strength of Material – By I.B. Prasad.
5. Engineering Mechanics – By Timosheenko, Young & Rao.
6. Engineering Mechanics – Beer & Johnson (TMH Publication).

Th.4(a). BASIC ELECTRICAL ENGINEERING
(1ˢᵗ sem Common)

Theory: 2 Periods per Week
Total Periods: 30 Periods
Examination: 1.5 Hours

I.A   :   10   Marks
End Sem Exam : 40   Marks
TOTAL MARKS : 50 Marks

Topic wise Distribution of Periods and Marks

Sl.No.	Topics	Periods
1	Fundamentals	05
2	A C Theory	08
3	Generation of Elect. Power	03
4	Conversion of Electrical Energy	07
5	Wiring and Power Billing	04
6	Measuring Instrument	03
	Total	**30**

Objective
1.   To be familiar with A.C Fundamental and circuits
2.   To be familiar with basic principle and application of energy conversion devices
3.   To be familiar with generation of Electrical power
4.   To be familiar with wiring and protective device
5.   To be familiar with calculation and commercial Billing of electrical power & energy
6.   To have basic knowledge of various electrical measuring instruments & conservation of electrical energy

1. FUNDAMENTALS
    1.1 Concept of current flow.
    1.2 Concept of source and load.
    1.3 State Ohm's law and concept of resistance.
    1.4 Relation of V, I & R in series circuit.
    1.5 Relation of V, I & R in parallel circuit.
    1.6 Division of current in parallel circuit.
    1.7 Effect of power in series & parallel circuit.
    1.8 Kirchhoff's Law.
    1.9 Simple problems on Kirchhoff's law.

2. A.C. THEORY
    2.1 Generation of alternating emf.
    2.2 Difference between D.C. & A.C.
    2.3 Define Amplitude, instantaneous value, cycle, Time period, frequency, phase angle, phase difference.
    2.4 State & Explain RMS value, Average value, Amplitude factor & Form factor with Simple problems.
    2.5 Represent AC values in phasor diagrams.
    2.6 AC through pure resistance, inductance & capacitance
    2.7 AC though RL, RC, RLC series circuits.
    2.8 Simple problems on RL, RC & RLC series circuits.
    2.9 Concept of Power and Power factor
    2.10 Impedance triangle and power triangle.

3. **GENERATION OF ELECTRICAL POWER**
   3.1 Give elementary idea on generation of electricity from thermal , hydro & nuclear
        power station with block diagram

4. **CONVERSION OF ELECTRICAL ENERGY**
   (No operation, Derivation, numerical problems)
   4.1 Introduction of DC machines.
   4.2   Main parts of DC machines.
   4.3   Classification of DC generator
   4.4   Classification of DC motor.
   4.5 Uses of different types of DC generators & motors.
   4.6 Types and uses of single phase induction motors.
   4.7 Concept of Lumen
   4.8 Different types of Lamps (Filament, Fluorescent, LED bulb) its Construction and
   Principle.
   4.9 Star rating of home appliances (Terminology, Energy efficiency, Star rating Concept)

5. **WIRING AND POWER BILLING**
   5.1   Types of wiring for domestic installations.
   5.2 Layout of household electrical wiring (single line diagram showing all the important
           component in the system).
   5.3   List out the basic protective devices used in house hold wiring.
   5.4   Calculate energy consumed in a small electrical installation

6. **MEASURING INSTRUMENTS**
   6.1   Introduction to measuring instruments.
   6.2   Torques in instruments.
   6.3   Different uses of PMMC type of instruments (Ammeter & Voltmeter).
   6.4   Different uses of MI type of instruments (Ammeter & Voltmeter).
   6.5   Draw the connection diagram of A.C/ D.C Ammeter, voltmeter, energy meter and
           wattmeter. (Single phase only).

Syllabus Coverage upto I.A
Chapter 1,2,3

BOOKS RECOMENDED:
1. ABC of Electrical Enginnering by Jain & Jain (Dhanpat Rai Publication)
2. Fundamentals of Electrical Engg and Electronics by B.L Thereja
3. Concept of Basic Electrical Enginnering ,P.K Das and A.K. Mallick by B.M Publications
4. Fundamentals of Electrical Engg by Asfaq Hussain
5. Fundamentals of Electrical Engg by JB Gupta
6. Basic Electrical Engg. By Chakraborti (Mcgraw Hill)

Th.4(b). BASIC ELECTRONIC ENGINEERING
(1st sem Common)

Theory: 2 Periods per Week	I.A : 10 Marks
Total Periods: 30 Periods	End Sem Exam : 40 Marks
Examination: 1.5 Hours	TOTAL MARKS : 50 Marks

Topic wise Distribution of Periods and Marks

Sl.No.	Topics	Periods
1	Electronic Devices	8
2	Electronic circuits	9
3	Communication System	3
4	Transducers & Measuring instruments	10
	Total	**30**

Objective

1. To be familiar with Electronic devices
2. To be familiar with Electronic circuits
3. To be familiar with communication system
4. To be familiar with Electronic measuring instruments

1. ELECTRONIC DEVICES
   1.1   Basic Concept of Electronics and its application.
   1.2   Basic Concept of Electron Emission & its types.
   1.3   Classification of material according to electrical conductivity (Conductor, Semiconductor & Insulator) with respect to energy band diagram only.
   1.4   Difference between Intrinsic & Extrinsic Semiconductor.
   1.5   Difference between vacuum tube & semiconductor.
   1.6   Principle of working and use of PN junction diode, Zener diode and Light Emitting Diode (LED)
   1.7   Integrated circuits (I.C) & its advantages.

2. ELECTRONIC CIRCUITS
   2.1   Rectifier & its uses.
   2.2   Principles of working of different types of Rectifiers with their merits and demerits
   2.3   Functions of filters and classification of simple Filter circuit (Capacitor, choke input and π)
   2.4 Working of D.C power supply system (unregulated) with help of block diagrams only
   2.5 Transistor, Different types of Transistor Configuration and state output and input current gain   relationship in CE,CB and CC configuration(No mathematical derivation)
   2.6 Need of biasing and explain different types of biasing with circuit diagram.(only CE configuration)
   2.7 Amplifiers(concept) , working principles of single phase CE amplifier
   2.8 Electronic Oscillator and its classification
   2.9 Working of Basic Oscillator with different elements through simple Block Diagram
   .
3. COMMUNICATION SYSTEM
   3.1 Basic communication system (concept & explanation with help of Block diagram)
   3.2 Concept of Modulation and Demodulation, Difference between them
   3.3 Different types of Modulation (AM, FM & PM) based on signal, carrier wave and modulated wave (only concept, No mathematical Derivation)

4. TRANSDUCERS AND MEASURING INSTRUMENTS

    4.1 Concept of Transducer and sensor with their differences.

    4.2 Different type of Transducers & concept of active and passive transducer.

    4.3 Working principle of photo emissive, photoconductive, photovoltaic transducer and its application

    4.4 Multimeter and its applications

    4.5 Analog and Digital Multimeter and their differences

    4.6 Working principle of Multimeter with Basic Block diagram

    4.7 CRO, working principle of CRO with simple Block diagram

Syllabus Coverage upto I.A
Chapter 1,2(upto 2.6)

BOOKS RECOMENDED:
1. Principles of Electronics by V.K Mehta and Rohit Mehta,S Chand Publication
2. Principles of Electronics by S.K. SAHADEV (Dhanpatrai Publication)

Th.3. ENGINEERING MATHEMATICS – II
(2nd Sem Common)

Theory: 5 Periods per Week
Total Periods: 75 Periods
Examination: 3 Hours

I.A : 20 Marks
End Sem Exam : 80 Marks
TOTAL MARKS : 100 Marks

Objective:

Principles and application in Engineering are firmly ground on abstract mathematical structures. Students passing from secondary level need familiarization with such structure with a view to develop their knowledge, skill and perceptions about the applied science. Calculus is the most important mathematical tool in forming engineering application into mathematical models. Wide application of calculus makes it imperative to develop methods of solving differential equations. The knowledge of limit, derivative and derivative needs to be exhaustively practiced. To help a systematic growth of skill in solving equation by calculus method will be the endeavor of this course content. Understanding the concept of co-ordinate system in 3D in case of lines, planes and sphere and it's use to solve Engineering problems. After completion of the course the student will be equipped with basic knowledge to form equations and solve them competently.

Topic wise distribution of periods

Sl. No.	Topics	Periods	Marks
1	Vector Algebra	15	12
2	Limits and Continuity	12	12
3	Derivatives	21	20
4	Integration	15	24
5	Differential Equation	12	12
	TOTAL	**75**	**80**

1) VECTOR ALGEBRA
   a) Introduction
   b) Types of vectors (null vector, parallel vector , collinear vectors)
        (in component form)
   c) Representation of vector
   d) Magnitude and direction of vectors
   e) Addition and subtraction of vectors
   f) Position vector
   g) Scalar product of two vectors
   h) Geometrical meaning of dot product
   i) Angle between two vectors
   j) Scalar and vector projection of two vectors
   k) Vector product and geometrical meaning
        (Area of triangle and parallelogram)

2) LIMITS AND CONTINUITY
   a) Definition of function, based on set theory
   b) Types of functions
   i) Constant function
   ii) Identity function
   iii) Absolute value function
   iv)The Greatest integer function
   v) Trigonometric function
    vi) Exponential function
   vii) Logarithmic function
   c) Introduction of limit
   d) Existence of limit
   e) Methods of evaluation of limit

i) $\lim_{x\to 0} \frac{x^n - a^n}{x - a} = na^{n-1}$

ii) $\lim_{x\to 0} \frac{a^x - 1}{x} = \log_e a$

iii) $\lim_{x\to 0} \frac{e^x - 1}{x} = 1$

iv) $\lim_{x\to 0} (1 + x)^{1/x} = e$

v) $\lim_{x\to \infty} \left(1 + \frac{1}{x}\right)^x = e$

vi) $\lim_{x\to 0} \frac{\log(1+x)}{x} = 1$

vii) $\lim_{x\to 0} \frac{\sin x}{x} = 1$

viii) $\lim_{x\to 0} \frac{\tan x}{x} = 1$

e) Definition of continuity of a function at a point and problems based on it

3) DERIVATIVES
a) Derivative of a function at a point
b) Algebra of derivative
c) Derivative of standard functions
$x^n, a^x, \log_a x$, $e^x, \sin x, \cos x, \tan x, \cot x, \sec x, \csc x, \sin^{-1} x, \cos^{-1} x,$
$\tan^{-1} x, \cot^{-1} x, \sec^{-1} x, \csc^{-1} x$
d) Derivative of composite function (Chain Rule)
e) Methods of differentiation of
  i) Parametric function
  ii) Implicit function
  iii) Logarithmic function
  iv) a function with respect to another function
f) Applications of Derivative
  i) Successive Differentiation (up to second order)
  ii) Partial Differentiation (function of two variables up to second order)
  g) Problems based on above

4) INTEGRATION
a) Definition of integration as inverse of differentiation
b) Integrals of standard functions
c) Methods of integration
  i) Integration by substitution
  ii) Integration by parts
d) Integration of the following forms
  i) $\int \frac{dx}{x^2 + a^2}$ ii) $\int \frac{dx}{x^2 - a^2}$ iii) $\int \frac{dx}{a^2 - x^2}$ iv) $\int \frac{dx}{\sqrt{x^2 + a^2}}$ v) $\int \frac{dx}{\sqrt{x^2 - a^2}}$ vi) $\int \frac{dx}{\sqrt{a^2 - x^2}}$
  vii) $\int \frac{dx}{x\sqrt{x^2 - a^2}}$ $viii) \int \sqrt{a^2 - x^2}\, dx$ ix) $\int \sqrt{a^2 + x^2}\, dx$ x) $\int \sqrt{x^2 - a^2}\, dx$
e) Definite integral, properties of definite integrals
  i) $\int_0^a f(x)\, dx = \int_0^a f(a - x)\, dx$
  ii) $\int_a^b f(x)\, dx = -\int_b^a f(x)\, dx$
  iii) $\int_a^c f(x)\, dx = \int_a^b f(x)\, dx + \int_b^c f(x)\, dx$, $a < b < c$
  iv) $\int_{-a}^a f(x)\, dx = 0, if\ f(x) =$ odd
  $\qquad\qquad = 2\int_0^a f(x)\, dx, if\ f(x) = even$
f) Application of integration
  i) Area enclosed by a curve and X – axis
  ii) Area of a circle with centre at origin

5) DIFFERENTIAL EQUATION
   a) Order and degree of a differential equation
   b) Solution of differential equation
      i) 1st order and 1st degree equation by the method of separation of variables
      ii) Linear equation $\frac{dy}{dx} + Py = Q$, where P,Q are functions of x

Syllabus to be covered up to IA
Ch. 2 and Ch. 3

Books Recommended:
1. Elements of Mathematics _ Vol. _ 1 & 2 (Odisha State Bureau of Text Book preparation & Production)

Reference Books:
   Mathematics Part- I & Part- II- Textbook for Class XII, NCERT Publication

Pr.1a. Communicative English Lab
(1st & 2nd sem Common)

Theory: 4 Periods per Week   Sessional   : 50 Marks
Total Periods: 60 Periods   TOTAL MARKS : 50 Marks

SI No.	Topic	Periods
1	Listening Skill	10
2	Speaking Skill	20
3	Personality Development	10
4	Interpersonal Skills	10
5	Presenting in G D , Seminar and Conferences	10
	Total	60

PRACTICAL

1. LISTENING SKILLS

- The student should be able to listen to a text read aloud in normal speed with focus on intonation
- After listening the student can fill-in-blanks, choose a suitable title, make a summary, supply required information and be able to answer comprehension questions from the passage read aloud.

2. SPEAKING SKILL
- Reading aloud of dialogues, texts, poems, speeches focusing on intonation.
- Self-introduction
- Role-plays on any two- situations
- Telephonic conversation

3. PERSONALITY DEVELOPMENT

- Initiation
- Physical appearance
- Audience purpose

4. INTERPERSONAL SKILLS

Appropriate use of non-verbal skills in face-to-face communication
[I.e. viva-   voice, group-interviews, GDs and seminars]

5. PRESENTING IN GD, SEMINARS AND CONFERENCES

- Leadership quality
- Time management
- Achieving the target

Pr.1b. COMPUTER APPLICATION LAB
(1st / 2nd sem Common)

Theory: 4 Periods per Week   Sessional : 50 Marks
Total Periods: 60 Periods   TOTAL MARKS : 50 Marks

1. BASIC COMPUTER OPERATION   [04]
Identification of different components of Computer Switch on and Booting Process Shut down, Restart of computer

2. PERSONAL COMPUTER SYSTEM   [12]
Study of device and power supply form factor of Personal Computer System
Identification of various Mother Board components
Identification of different ports, type of connectors, and their purpose, Cooling System of Processor and Case
Identification and Study of ROM, RAM, Adapter Cards, Expansion Slots,SATA connectors
Study of Adapters and Converters

3. COMPUTER LAB SAFETY AND STUDY OF LAB TOOLS   [06]
Study of various types of LAB Safety measures (General Safety, Electrical Safety, Fire safety), Analysis of various Power Fluctuation Types (Blackout, Brownout, Noise, Spike, Power surge), Power Protection Devices (Surge suppressor, UPS, Standby power supply)
Procedures for proper disposal or recycling of hazardous computer components (Batteries, Monitors, Toner Kits, Cartridges, Chemical Solvents and Aerosol Cans)
Study of General Lab Tools (ESD tools, Hand tools, cable tools, Cleaning tools, Diagnostic tools), Disk Management Tools

4. OPERATINGSYSTEM   [08]
Basic DOS commands (CLS, DIR, DATE, TIME, VERSION, MD, CD, RD, DEL, COPY, REN, USE OF WILD CARDS, PATH), Basic Windows OS operations, MOUSE OPERATIONS, Utilities and Accessories, Installation and configuration of OS

5. WORKING WITH MS-OFFICE   [12]
Basic operations of Word Processing Package. (MS-Word), Basic operations of Electronic Spread Sheet Package. (MS-Excel), Basic operations of Presentation Package (MS- Power point) *(Create, Edit, Format, Save, Print/View in the above three packages)*

6. WORKING WITH INTERNET   [06]
Getting acquainted with Internet connection, Browser, website
URL, webpage, http, WWW, net browsing
Creating E-Mail Id, sending and receiving E-mail Chatting

7. C PROGRAMMING   [12]
1. Write a Program in C to find the greatest number among three numbers.
2. Write a Program in C to find the average of n numbers by using for loop.
3. Write a program in C to determine whether a number is prime or not?
4. Write a program in C to check whether a given number is palindrome or not?
5. Write a program in C to compute the sine series.
6. Write a program in C to accept row wise and column wise element in a two dimensional array and print them.
7. Write a program in C to find the vowels in a given string.
8. Write a program in C to find the factorial of a number, by using recursion.
9. Write a program in C to find the sum of Fibonacci series, by using function.
10. Write a program in C to accept a number from keyboard and print it in reverse order of entry, by using function.

Pr.2a. Engineering Physics Lab
(1st / 2nd sem Common)

Theory: 4 Periods per Week   Sessional   : 50   Marks
Total Periods: 60 Periods   End Sem Exams   : 50 Marks
Examinatio: 3 Hours   TOTAL MARKS   :100 Marks

(Any 10 Experiments)

SL.NO	NAME OF THE EXPERIMENTS
1	To find the cross sectional area of a wire using a screw gauge.
2	To find the thickness and volume of a glass piece using a screw gauge.
3	To find volume of a solid cylinder using a Vernier Calipers.
4	To find volume of a hollow cylinder using a Vernier Calipers.
5	To determine the radius of curvature of convex surface using a Spherometer.
6	To determine the radius of curvature of concave surface using a Spherometer.
7	To find the time period of a simple pendulum and determine acceleration due to gravity.
8	To determine the angle of Prism.
9	To determine the angle of Minimum Deviation by I ~ D curve method.
10	To trace lines of force due to a bar magnet with North pole pointing North and locate the neutral points.
11	To trace lines of force due to a bar magnet with North pole pointing South and locate the neutral points.
12	To verify Ohm's Law by Ammeter – Voltmeter method.

Pr.2b. Engineering Chemistry Lab
(1st / 2nd sem Common)

Theory: 4 Periods per Week   Sessional   : 50   Marks
Total Periods: 60 Periods   End Sem Exams   : 50 Marks
Examinatio: 3 Hours   TOTAL MARKS   :100 Marks

SI No.	Experiment
1	Preparation and study of physical and chemical properties CO_2 gas.
2	Preparation and study of physical and chemical properties NH_3 gas.
3	Crystallization of Copper sulphate from copper carbonate.

4	Simple acid-base titrations
	    (i) Acidimetry
	    (ii) Alkalimetry

5	Tests for acid radicals (Known):
	    (i) Carbonate,
	    (ii) Sulphide,
	    (iii) Chloride,
	    (iv) Nitrate and
	    (v) Sulphate.

6	Test for Basic radicals (Known):
	    (i) Ammonium,
	    (ii) Zinc,
	    (iii) Magnesium,
	    (iv) Aluminium,
	    (v) Calcium,
	    (vi) Sodium and
	    (vii) potassium.

7	Test for unknown Acid radicals
8	Test for unknown basic radicals
9	Test for unknown salt (composed of one basic radical and one acid radical)

Recommended Books:
    (i)   Practical Intermediate Chemistry By Dr. Bichitrananda Nanda
    (ii)   Elemental Experimental chemistry by Dr. Y R Sharma, A K Das, Kalyani Publisher

Pr.3a. Engineering Drawing
(1st / 2nd sem Common)

Theory: 6 Periods per Week   Sessional   : 50 Marks
Total Periods: 90 Periods   End Sem Exams : 100 Marks
Examination: 3 Hours   TOTAL MARKS : 150 Marks

Objective
After completion of the study of Engg. Drawing the student should be able to

1. Understand the importance of Engineering Drawing.
2. Demonstrate the use of different drawing instrument.
3. Make free hand lettering and numbering.
4. Practice of dimensioning of drawing.
5. Undertake different geometric constructions, projections of straight line, planes and solids.
6. Take up different orthographic projections.
7. Draw sectional views, development of surface of different solids.
8. Develop the concept of building drawing.
9. Prepare 2D engineering drawing using Auto CAD software.

Topic wise distribution of periods.

Sl. No.	Topics	Periods
1	Introduction and Demonstration	03
2	Types of Lines, Lettering & Dimensioning	03
3	Scales	03
4	Curves	06
5	Orthographic Projections	21
6	Section and Developments	21
7	Isometric Projections	06
8	Building Drawing	12
9	Practices on Auto CAD	15
	TOTAL	**90**

(All drawings are to be made in First Angle Projection)

1. **INTRODUCTION & DEMONSTRATION**
    1.1 Identify various sizes of drawing boards, drawing sheets as pr BIS.
    1.2 List the types of pencils, instruments, and scales (RF).
    1.3 Demonstrate lying of drawing sheet, margin, standard layout and title block as per BIS, folding principle of drawings (blue prints, print outs etc).

2. **TYPES OF LINES, LETTERING & DIMENSIONING**
    2.1 Demonstrate and explain the use of various types of lines.
    2.2 Demonstrate the principle of single stroke, gothic lettering & numerals as per BIS.

3. **SCALES**
    3.1 Significance of scales in drawing; different scales.
    3.2 Define and draw plain sale and diagonal sale.

4. CURVES
4.1 Explain Conic sections with illustration, Explain terms like focus, vertex, directrix and eccentricity.
4.2 Draw conics sections by eccentricity method – Ellipse, Parabola and Hyperbola.
4.3 Draw Ellipse by concentric circle method sand arc of cicle method.
4.4 Draw parabola by Rectangle Method and Tangent Method.

5. OTHOGRAPHIC PROJECTIONS
5.1 Demonstrate the principles of 1st angle and 3rd angle projections with the help of models and draw symbols.
5.2 Draw projection of points.
5.3 Draw projection of straight line (parallel to both planes, parallel to one and perpendicular to other, parallel to one and inclined to other and inclined to both reference planes).
5.4 Draw plane figure such as squares, rectangles, triangles, circle, Pentagon and hexagon
(perpendicular to one plane and inclined to other).
5.5 Draw projections of solids such as prism, cylinder, cone, tetrahedron and pyramid in simple position (with axis parallel to one reference plane and perpendicular to other reference plane).

6. SECTION & DEVELOPMENTS
6.1 Draw the sectional projection & development of prism, cylinder, cone and pyramid in simple position by a cutting plane perpendicular to one reference plane and inclined to other reference plane.
6.2 Draw true shape of the cutting sections.

7. ISOMETRIC PROJECTIONS
Draw isometric view & Isometric projection of prism, pyramid, cone & cylinder with axis horizontal and vertical with construction of isometric scales.

8. BUILDING DRAWING
8.1 Explain terms related to building drawing.
8.2 Draw plan, elevation of single room building with verandah (Flat roof according to given line plan and specification).

9. PRACTICES ON AUTO CAD
9.1 Introduction-Settings, Limits etc.
9.2 Auto CAD commands-
Draw commands (Line, circle, are polygon, ellipse, rectangle).
Edit command, Dimension commands and Modify Commands for two dimensional drafting only.
9.3 Exercise for practice using Auto CAD.
    9.3.1 Orthographic projections of lines, planes sand solids as per chapter 5.0.
    9.3.2 Isometric projection as per Chapter 7.0.
Note: Focus should be on Hands on Practice of student using AutoCAD software

Books Recommended
1. Machine Drawing by Basudeb Bhattacharya, Oxford University Press.
2. A Text Book of Engineering Drawing by Dr. R.K. Dhawan.
3. A Text Book of Engineering Graphics & Auto CAD by K Venugopal.
4. A Text book of Engineering Drawing by N.D. Bhatt.
5. Engineering Drawing by P.S. Gill.
6. A Introduction to Auto CAD – 2012 by George Omura, Willey India Publishers.

Pr.3b. Workshop Practice
(1st / 2nd sem Common)

Theory: 6 Periods per Week   Sessional   : 50 Marks
Total Periods: 90 Periods   End Sem Exams : 100   Marks
Examination: 4 Hours   TOTAL MARKS : 150 Marks

Objective:

1. To demonstrate safely practice in various shops of the workshop.
2. To select suitable tools & equipment in the following shops. (a) Fitting.
   (b) Sheet Metal.
   (c) Welding (Gas & Electrical). (d) Turning.
3. To select suitable materials for different process in the above shops.
4. To demonstrate the different processes adopted in the above shops.
5. To finish the jobs within stipulated time and with accuracy as per specifications.

Topic Wise distribution of periods

Sl. No.	Topics	Periods
1	Fitting Shop	24
2	Sheet Metal	18
3	Welding Shop	24
4	Turning Shop	21
5	Exposure to CNC Milling / Lathe Machine	03
	TOTAL	**90**

1. FITTING SHOP

1.1 Demonstrate safety practices in the fitting shop.
1.2 Select suitable holding & clamping devices for fitting jobs.
1.3 Select suitable tools like- files, vice, chisels, punch, scriber, hammers, surface plate, V-block, try square, caliper etc.
1.4 Demonstrate the following operations:
Sawing, Chipping, Fitting, Craping, Grinding, Marking, Reaming, Tapping, Drilling & Angular cutting.
1.5 Introduction of chipping, demonstration on chipping and its applications.
1.6 Description, demonstration and practice of simple operation of hack saw straight and angular cutting.
1.7 Introduction and use of measuring tools used in fitting shop like steel rule, measuring tape, outside micrometer, vernier caliper and vernier height gauge.
1.8 Description and Demonstration and practice of thread cutting using taps and dies.
Job: Cutting & fitting practice on a square of 50mm X 50mm X 8mm
MS Flat. Job: Angular cutting practice of 45 degree (on the above job).
Job: Preparation of stud (to cut external threads) with the help of dies (mm or BSW). Job: H-fitting in the mild steel (ms) square.
Job: Prepare one job on male female fitting.

2. **SHEET METAL**
   2.1   Demonstrate safety practices in sheet metal shop.
   2.2   Prepare surface development for the jobs according to the drawing.
   2.3   Cut M.S and G.P. sheets according to the surface development / drawing using standard sheet metal cutting tools.
   2.4   Select hand tools for sheet metal work.
   2.5   Demonstrate the process of metal clamp joining and reveted joining of sheet metals.
       Job: Making of sheet metal joints.
       Job: Prepare a sheet metal tray or a funnel.
       Job: Prepare a sheet metal job involving rolling, shearing, creasing, bending & cornering. Job: Prepare a lap riveting joint.

3. **WELDING SHOP**
   3.1   Introduction.
   3.2   Safety precautions in welding, safety equipments & its application in welding shop.
   3.3   Introduction to welding, type of welding, common materials that can be welded, introduction to gas welding equipment, types of flame, adjustment of flame, applications of gas welding, Welding tools & safety precautions.
   3.4   Introduction to electric arc welding (AC & DC), practice in setting current & voltage for striking proper arc, precautions while using electric arc welding. Applications of arc welding. Introduction to polarity & their use.
   3.5   Demonstrate & use of the different tools used in the welding shop with sketches, Hand shield, helmet, clipping hammer, gloves, welding lead, connectors, aprons, goggles, etc.
   3.6   Demonstrate of welding defects & various types of joints & end preparation.
       Job: Preparation of lap joint by arc welding rod. Job: Preparation of Tee joint by arc welding.
       Job: Preparation of single V or double V butt joint by electric arc welding. Job: Brazing practice. Use of Spelt or (on MS sheet pieces).
       Job: Gas welding practice on worn-out & broken parts.

4. **TURNING SHOP**
   4.1   Introduction.
   4.2   Safety precaution & safety equipments.
   4.3   Various marking, measuring, cutting & holding tools.
   4.4   Demonstration of different parts of a lathe, demonstration on centering & turning operation in a group of 06 students.
       Job: plain turning, taper turning & grooving practices on round bar.

5. **EXPOSURE TO C.N.C MILLING / LATHE MACHINE**

Reference Books
1.   Workshop Technology by S.K.Hajara Choudhray, Media Promoters Publishers, New Delhi.
2.   Workshop Technology by B.S. Raghubanshi, Dhanpat Rai and Sons, New Delhi.
3.   Workshop Technology by H.S. Bawa – TMH.
4.   Workshop Familiarization by E Wilkinson.
5.   Sheet metal shop practice by Bruce & Meyer.
6.   Workshop Technology by R.S. Khurmi & J.K. Gupta, S.Chand.
Notes
1.   Work, Progress book should be maintained continuously.
2.   The roll numbers of the students must be punched on each job.
3.   The turning shop job should be done by students' maximum 06 students in a group

Pr.4 Seminar
(1st / 2nd sem Common)

Theory: 4 Periods per Week   Sessional   : 50 Marks
Total Periods: 60 Periods   TOTAL MARKS : 50 Marks

The students shall present seminar on different topics on latest science and Technology in the entire class. There shall not be any grouping of students. The students shall present the seminar topic to the whole class/section. All other students should be allowed and encouraged to put questions to the presenter student, who shall answer the questions. A student has to present seminar on at least 2 topics in a semester. He/she has to submit seminar report for each topic separately, to the teacher concerned, which shall be preserved for verification by the authorities. The students should be encouraged to refer to the magazines, journals ,e-materials etc. for preparing for seminar topic. Attendance of all students other than the presenters should be ensured, so that seminar shall be more participative and knowledge of students shall improve by listening to many topics presented.

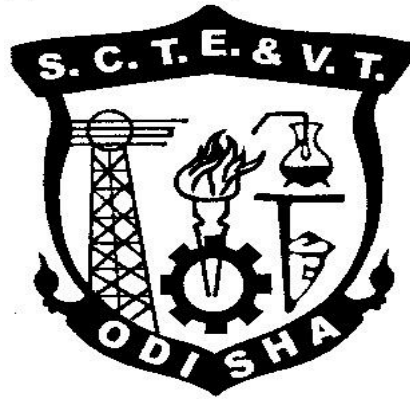| STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA									
TEACHING AND EVALUATION SCHEME FOR 3rd Semester Mechanical Engg.(wef 2019-20)									
Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		Production Technology	4		-	20	80	3	100
Th.2		Strength of Material	4		-	20	80	3	100
Th.3		Engineering. Material	4		-	20	80	3	100
Th.4		Thermal Engineering-I	4			20	80	3	100
Th.5		Environmental studies	4			20	80	3	100
		Total	20			100	400	-	500
		Practical							
Pr.1		Mechanical Engg. Drawing	-	-	6	25	50	3	75
Pr.2		Mechanical Engg. Lab-I	-	-	4	25	50	3	75
Pr.3		Workshop-II	-	-	6	50	50	4	100
		Student Centred Activities(SCA)		-	3	-	-	-	-
		Total	-	-	19	100	150	-	250
		Grand Total	20	-	19	200	550	-	750
Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration									
Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%									
SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc. ,Seminar and SCA shall be conducted in a section.									
There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester									

CURRICULLUM OF 3RDSEMESTER

For

DIPLOMA IN MECHANICAL ENGINEERING

(Effective FROM 2019-20 Sessions)

STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING, ODISHA, BHUBANESWAR

TH-1   PRODUCTION TECHNOLOGY

Name of the Course: Diploma in **Mech/Auto/Aero & Other Mechanical Allied Branches**

Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	I.A	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE :

Production Technology involves a working knowledge in the field of product design, product development and rapid part production. It deals with the production methodology and its management to make a complete analysis on the products.

B. COURSE OBJECTIVES

At the end of the course the students will be able to
1. Understand the different components and processes involved in press tool operation.
2. Understand how to minimize the job setting and tool setting times in mass production.
3. Understand the industrial requirements of fabrication systems.
4. Understand the manufacturing processes like casting and powder metallurgy.

C. CHAPTER WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
01	Metal Forming Processes	07
02	Welding	16
03	Casting	16
04	Powder Metallurgy	07
05	Press Work	07
06	Jigs and fixtures	07
	Total Period:	60

D. COURSE CONTENTS

1.0   Metal Forming Processes
    1.1   Extrusion: Definition & Classification
    1.2   Explain direct, indirect and impact extrusion process.
    1.3   Define rolling. Classify it.
    1.4   Differentiate between cold rolling and hot rolling process.
    1.5   List the different types of rolling mills used in Rolling process.

2.0   Welding
    2.1   Define welding and classify various welding processes.
    2.2   Explain fluxes used in welding.
    2.3   Explain Oxy-acetylene welding process.
    2.4   Explain various types of flames used in Oxy-acetylene welding process.
    2.5   Explain Arc welding process.
    2.6   Specify arc welding electrodes.
    2.7   Define resistance welding and classify it.
    2.8   Describe various resistance welding processes such as butt welding, spot welding, flash welding, projection welding and seam welding.

2.9   Explain TIG and MIG welding process

2.10   State different welding defects with causes and remedies.

3.0   **Casting**

3.1   Define Casting and Classify the various Casting processes.

3.2   Explain the procedure of Sand mould casting.

3.3   Explain different types of molding sands with their composition and properties.

3.4   Classify different pattern and state various pattern allowances.

3.5   Classify core.

3.6   Describe construction and working of cupola and crucible furnace.

3.7   Explain die casting method.

3.8   Explain centrifugal casting such as true centrifugal casting, centrifuging with advantages, limitation and area of application.

3.9   Explain various casting defects with their causes and remedies.

4.0   **Powder Metallurgy**

4.1   Define powder metallurgy process.

4.2   State advantages of powder metallurgy technology technique

4.3   Describe the methods of producing components by powder metallurgy technique.

4.4   Explain sintering.

4.5   Economics of powder metallurgy.

5.0   **Press Work**

5.1   Describe Press Works: blanking, piercing and trimming.

5.2   List various types of die and punch   7

5.3   Explain simple, Compound & Progressive dies

5.4   Describe the various advantages & disadvantages of above dies

6.0   **Jigs and fixtures**

6.1   Define jigs and fixtures

6.2   State advantages of using jigs and fixtures

6.3   State the principle of locations

6.4   Describe the methods of location with respect to 3-2-1 point location of rectangular jig

6.5   List various types of jig and fixtures.

Syllabus to be covered up to IA- Chapters 1, 2&3

LEARNING RESOURCES

Sl. No.	Author	Title of the book	Publisher
01	O.P. Khanna	Production Technology, Vol- I& II	Dhanpat Rai Publication
02	B.S Raghuwanshi	Workshop technology, Vol- I& II	Dhanpat Rai & Co
03	P.N. Rao	Manufacturing technology, Vol- I&II	TMH
04	P.C.Sharma	Manufacturing technology, Vol- I	S. Chand

TH-2   STRENGTH OF MATERIAL

Name of the Course: Diploma in **Mech/Auto/Aero & Other Mechanical Allied Branches**			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	I.A TEST	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE :

Strength of material deals with the internal behaviors of solid bodies under the action of external force. The subject focuses on mechanical properties of material analysis of stress, strain and deformations. Therefore it is an important basic subject of students for Mechanical and Automobile Engg.

B. COURSE OBJECTIVES:

Students will develop ability towards

- Determination of stress, strain under uniaxial loading (due to static or impact load and temperature) in simple and single core composite bars.
- Determination of stress, strain and change in geometrical parameters of cylindrical and spherical shells due to pressure
- Realization of shear stress besides normal stress and computation of resultant stress in two dimensional objects.
- Drawing bending moment and shear force diagram and locating points in a beam where the effect is maximum or minimum.
- Determination of bending stress and torsional shear stress in simple cases
- Understanding of critical load in slender columns thus realizing combined effect of axial and bending load.

C. CHAPTER WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
01	Simple Stress & Strain	10
02	Thin cylindrical and spherical shell under internal pressure	08
03	Two dimensional stress systems	10
04	Bending moment& shear force	10
05	Theory of simple bending	10
06	Combined direct & Bending stresses	06
07	Torsion	06
	Total Period:	60

D. COURSE CONTENTS

1.0   Simple stress& strain

1.1   Types of load, stresses & strains,(Axial and tangential) Hooke's law, Young's modulus, bulk modulus, modulus of rigidity, Poisson's ratio, derive the relation between three elastic constants,

1.2   Principle of super position, stresses in composite section

1.3   Temperature stress, determine the temperature stress in composite bar (single core)

1.4   Strain energy and resilience, Stress due to gradually applied, suddenly applied and impact load

1.5   Simple problems on above.

2.0   Thin cylinder and spherical shell under internal pressure

2.1   Definition of hoop and longitudinal stress, strain

2.2   Derivation of hoop stress, longitudinal stress, hoop strain, longitudinal strain and volumetric strain

2.3   Computation of the change in length, diameter and volume

2.4   Simple problems on above

3.0   Two dimensional stress systems

3.1   Determination of normal stress, shear stress and resultant stress on oblique plane

3.2   Location of principal plane and computation of principal stress

3.3   Location of principal plane and computation of principal stress and Maximum shear stress using Mohr's circle

4.0   Bending moment& shear force

4.1   Types of beam and load

4.2   Concepts of Shear force and bending moment

4.3   Shear Force and Bending moment diagram and its salient features illustration in cantilever beam, simply supported beam and over hanging beam under point load and uniformly distributed load

5.0   Theory of simple bending

5.1   Assumptions in the theory of bending,

5.2   Bending equation, Moment of resistance, Section modulus& neutral axis.

5.3   Solve simple problems.

6.0   Combined direct & bending stresses

6.1   Define column

6.2   Axial load, Eccentric load on column,

| 6.3 | Direct stresses, Bending stresses, Maximum& Minimum stresses. Numerical problems on above. |
| 6.4 | Buckling load computation using Euler's formula (no derivation) in Columns with various end conditions |

7.0   Torsion

7.0	Assumption of pure torsion
7.1	The torsion equation for solid and hollow circular shaft
7.2	Comparison between solid and hollow shaft subjected to pure torsion

Syllabus to be covered up to I.A   -   Chapters 1, 2, 3&4

Learning resources:

Sl. No.	Author	Title of the book	Publisher
01	S Ramamrutham	Strength of Materials	Dhanpat Rai
02	R K Rajput	Strength of Materials	S.Chand
03	R.S khurmi	Strength of Materials	S.Chand
04	G H Ryder	Strength of Materials	Mc millon and co. lmtd
05	S Timoshenko and D H Young	Strength of Materials	TMH

TH-3   ENGINEERING MATERIAL

Name of the Course: Diploma in **Mech/Auto/Aero & Other Mechanical Allied Branches**			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/week	IA	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Entire field of engineering deals with use of host of materials for making objects for human need. These materials include wide spectrum of element, metals, alloys and compounds with diverse properties. It is imperative that an engineer from any field should have a good knowledge of such materials and their properties.

B. COURSE OBJECTIVES:

After completion of the course students will have the ability of

- Realizing material requirements
- Realizing application area of ferrous, non ferrous and alloys
- Comprehending micro-structural changes during iron-carbon phase transformation process
- Comprehending effect of heat treatment and its effect towards change in material properties
- Comprehending continuity during evolution in engineering materials and development of modern engineering materials.

C. CHAPTER WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
01	Engineering materials and their properties	05
02	Ferrous Materials and alloy	05
03	Iron – Carbon system	08
04	Crystal imperfections	10
05	Heat Treatment	10
06	Non-ferrous alloys	10
07	Bearing Material	03
08	Spring materials	03
09	Polymers	03
10	Composites and Ceramics	03
	Total Period:	60

D.   COURSE CONTENT:

1.0   Engineering materials and their properties
    1.1   Material classification into ferrous and non ferrous category and alloys
    1.2   Properties of Materials: Physical , Chemical and Mechanical
    1.3   Performance requirements
    1.4   Material reliability and safety

2.0   Ferrous Materials and alloys
    2.1   Characteristics and application of ferrous materials
    2.2   Classification, composition and application of low
         carbon steel, medium carbon steel and High carbon steel
    2.3   Alloy steel: Low alloy steel, high alloy steel, tool steel and
         stainless steel
    2.4   Tool steel: Effect of various alloying elements such as Cr, Mn,
         Ni, V, Mo,

3.0   Iron – Carbon system
    3.1   Concept of phase diagram and cooling curves
    3.2   Features of Iron-Carbon diagram with salient micro-constituents
         of Iron and Steel

4.0   Crystal imperfections
    4.1   Crystal defines, classification of crystals, ideal crystal and
         crystal imperfections
    4.2   Classification of imperfection: Point defects, line defects,
         surface defects and volume defects
    4.3   Types and causes of point defects: Vacancies,
         Interstitials and impurities
    4.4   Types and causes of line defects: Edge dislocation and
         screw dislocation
    4.5   Effect of imperfection on material properties
    4.6   Deformation by slip and twinning
    4.7   Effect of deformation on material properties

5.0   Heat Treatment
    5.1   Purpose of Heat treatment
    5.2   Process of heat treatment: Annealing, normalizing,
         hardening, tampering, stress relieving measures
    5.3   Surface hardening: Carburizing and Nitriding
    5.4   Effect of heat treatment on properties of steel
    5.5   Hardenability of steel

6.0   Non-ferrous alloys
    6.1   Aluminum alloys: Composition, property and usage of
         Duralmin, y- alloy.
    6.2   Copper alloys: Composition, property and usage of Copper-
         Aluminum, Copper-Tin, Babbit , Phosperous bronze, brass,
         Copper- Nickel
    6.3   Predominating elements of lead alloys, Zinc alloys and Nickel alloys
    6.4   Low alloy materials like P-91, P-22 for power plants and other

high temperature services. High alloy materials like stainless
steel grades of duplex, super duplex materials etc.

7.0   Bearing Material

7.1   Classification, composition, properties and uses of Copper
base, Tin Base, Lead base, Cadmium base bearing materials

8.0   Spring materials

8.1   Classification, composition, properties and uses of Iron-
base and Copper base spring material

9.0   Polymers

9.1   Properties and application of thermosetting and thermoplastic polymers
9.2   Properties of elastomers

10.0   Composites and Ceramics

10.1   Classification, composition, properties and uses of particulate
based and fiber reinforced composites
10.2   Classification and uses of ceramics

Syllabus to be covered up to I.A -   Chapters 1, 2, 3, 4&5

Learning resources:

Sl. No.	Author	Title of the book	Publisher
01	O P Khanna	A Textbook of Material Science and Metallurgy	Dhantpat Rai
02	R K Rajput	Engineering materials and Metallurgy	S.Chand
03	S K Hazra choudhry	Material science & process	Imdian Book Distrubuting

TH - 4   THERMAL ENGINEERING-I

Name of the Course: Diploma in **Mech/Auto/Aero & Other Mechanical Allied Branches/E&M**			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/week	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Thermal Engineering is the field of applied science which deals with energy possessed by heated gases and the laws which give the conversion of this energy into mechanical energy and vice versa

B. COURSE OBJECTIVES:

After the completion of the course the students will develop ability towards.

- Comprehending significance of thermodynamics properties in order to analyze a Thermodynamic system.
- Comprehending & applying first & second law of thermodynamics in closed & open system.
- Comprehending & applying gas laws applicable to perfect gas in order to determine Thermodynamic properties.
- Comprehending the concept of I.C engine and gas power cycle & computing work done & efficiency thereof.

C. CHAPTER WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
01	Thermodynamic concept & Terminology	12
02	Laws of Thermodynamics	12
03	Properties Processes of perfect gas	10
04	Internal combustion engine	08
05	Air Standard Cycle	10
06	Fuels and Combustion	08
	Total Period:	60

D.   COURSE CONTENT:

1. Thermodynamic concept & Terminology

   1.1 Thermodynamic Systems (closed, open, isolated)
   1.2 Thermodynamic properties of a system (pressure, volume, temperature, entropy, enthalpy, Internal energy and units of measurement).
   1.3 Intensive and extensive properties
   1.4 Define thermodynamic processes, path, cycle , state, path function, point function.
   1.5 Thermodynamic Equilibrium.
   1.6 Quasi-static Process.
   1.7 Conceptual explanation of energy and its sources
   1.8 Work , heat and comparison between the two.
   1.9 Mechanical Equivalent of Heat.
   1.10 Work transfer, Displacement work

2. Laws of Thermodynamics

   2.1 State & explain Zeroth law of thermodynamics.

2.2 State & explain First law of thermodynamics.

2.3 Limitations of First law of thermodynamics

2.4 Application of First law of Thermodynamics (steady flow energy equation and its application to turbine and compressor)

2.4 Second law of thermodynamics (Claucius & Kelvin Plank statements).

2.5 Application of second law in heat engine, heat pump, refrigerator & determination of efficiencies & C.O.P (solve simple numerical)

3. **Properties Processes of perfect gas**

3.1 Laws of perfect gas:

Boyle's law, Charle's law, Avogadro's law, Dalton's law of partial pressure, Guy lussac law, General gas equation, characteristic gas constant, Universal gas constant.

3.2 Explain specific heat of gas (Cp and Cv)

3.3 Relation between Cp & Cv.

3.4 Enthalpy of a gas.

3.5 Work done during a non- flow process.

3.6 Application of first law of thermodynamics to various non flow process (Isothermal, Isobaric, Isentropic and polytrophic process)

3.6 Solve simple problems on above.

3.7 Free expansion & throttling process.

4. **Internal combustion engine**

4.1 Explain & classify I.C engine.

4.2 Terminology of I.C Engine such as bore, dead centers, stroke volume, piston speed &RPM.

4.3 Explain the working principle of 2-stroke & 4- stroke engine C.I & S.I engine.

4.4 Differentiate between 2-stroke & 4- stroke engine C.I & S.I engine.

5. **Gas Power Cycle**

5.1 Carnot cycle

5.2 Otto cycle.

5.3 Diesel cycle.

5.4 Dual cycle.

5.5 Solve simple numerical.

6. **Fuels and Combustion**

6.1 Define Fuel.

6.2 Types of fuel.

6.3 Application of different types of fuel.

6.4 Heating values of fuel.

6.5 Quality of I.C engine fuels Octane number, Cetane number.

Syllabus to be covered up to I.A - Chapters 1, 2&3

Learning resources:

Sl. No.	Author	Title of the book	Publisher
01	R.S. Khurmi	Thermal Engineering	S.Chand
02	A.R.Basu	Thermal Engineering	Dhanpat Rai
03	A.S. Sarao	Thermal Engineering	Satya Prakash
04	P.K.Nag	Engineering Thermodynamics	TMH
05	Mahesh M Rathore	Thermal Engineering	TMH

TH.5 ENVIRONMENTAL STUDIES
(Common to All Branches)

Theory: 4 Periods per Week   I.A: 20   Marks
Total Periods: 60 Periods   End Exam : 80 Marks
Examination: 3 Hours   TOTAL MARKS : 100   Marks

A. RATIONALE:

Due to various aspects of human developments including the demand of different kinds of technological innovations, most people have been forgetting that, the Environment in which they are living is to be maintained under various living standards for the preservation of better health. The degradation of environment due to industrial growth is very much alarming due to environmental pollution beyond permissible limits in respect of air, water industrial waste, noise etc. Therefore, the subject of Environmental Studies to be learnt by every student in order to take care of the environmental aspect in each and every activity in the best possible manner.

B. OBJECTIVES:

After completion of study of environmental studies, the student will be able to:

1. Gather adequate knowledge of different pollutants, their sources and shall be aware of solid waste management systems and hazardous waste and their effects.
2. Develop awareness towards preservation of environment.

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	The Multidisciplinary nature of environmental studies	04
2	Natural Resources	10
3	Systems	08
4	Biodiversity and it's Conservation	08
5	Environmental Pollution.	12
6	Social issues and the Environment	10
7	Human population and the environment	08
	Total:	**60**

D.COURSE CONTENT:

Unit 1: The Multidisciplinary nature of environmental studies

Definition, scope and importance, Need for public awareness.

Unit 2: Natural Resources

Renewable and non renewable resources:

a) Natural resources and associated problems.
- Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.
- Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.
- Food Resources: World food problems ,changes caused by agriculture and overgrazing,effectsofmodernagriculture,fertilizers-pesticidesproblems, water logging, salinity,.
- Energy Resources: Growing energy need, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
- Land Resources: Land as a resource ,land degradation ,man induces landslides, soil erosion, and desertification.

b) Role of individual in conservation of natural resources.

c) Equitable use of resources for sustainable lifestyles.

Unit 3: Systems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers, decomposers.
- Energy flow in the ecosystems.
- Ecological succession.
- Food chains, food web sand ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem:
- Forest ecosystem:
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit 4: Biodiversity and it's Conservation

- Introduction-Definition: genetics, species and ecosystem diversity.
- Biogeographically classification of India.
- Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and opt in values.
- Biodiversity at global, national and local level.
- Threats to biodiversity: Habitats loss, poaching of wild life, man wildlife conflicts.

Unit 5: Environmental Pollution.

Definition Causes, effects and control measures of:

a) Air pollution.
b) Water pollution.
c) Soil pollution
d) Marine pollution

e) Noise pollution.
f) Thermal pollution
g) Nuclear hazards.

Solid waste Management: Causes, effects and control measures of urban and

industrial wastes.

Role of an individual in prevention of pollution.

Disaster management: Floods, earth quake, cyclone and landslides.

Unit 6: Social issues and the Environment

From unsustainable to sustainable development.

- Urban problems related to energy.
- Water conservation, rain water harvesting, water shed management.
- Resettlement and rehabilitation of people; its problems and concern.
- Environmental ethics: issue and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.
- Air (prevention and control of pollution) Act.
- Water (prevention and control of pollution) Act.
- Public awareness.

Unit 7: Human population and the environment

- Population growth and variation among nations.
- Population explosion-family welfare program.
- Environment and human health.
- Human rights.
- Value education
- Role of information technology in environment and human health.

Syllabus to be covered up to I.A   Units 1, 2, 3

Learning Resources:			
Sl.No	Title of the Book	Name of Authors	Name of Publisher
1	Text book of Environmental studies	Erach Bharucha	#UGC
2	Fundamental concepts in Environmental Studies	,D.D .Mishra	S. Chand&Co-Ltd
3	Textbook of Environmental Studies	K.Raghavan Nambiar	SCITECH Publication Pvt. Ltd.
4	Environmental Engineering	V.M.Domkundwar	- DhanpatRai&Co

MECHANICAL ENGINEERING DRAWING (PR-1)

Name of the Course: Diploma in **Mech/Auto/Aero & Other Mechanical Allied Branches**			
Course code:		Semester	3rd
Total Period:	90	Examination	3 hrs
Lab Periods:	6 P/week	Sessional:	25
Maximum marks:	75	End Semester Examination:	50

COURSE OBJECTIVES:-

Students will develop ability towards

- Recognizing significance of standardized representations
- Comprehending role of various fastening elements and offer engineering drawing thereof in manual mode
- Comprehending geometrical constraints and function of components in assemblies such as bearings and screw jack
- Comprehending functional requirement of major components and offer engineering drawing in manual mode thereof.

Chapter   **Contents**

1.0   Revision of Engineering Drawing of 1st Year
2.0   Draw plan, elevation and side view of different machine elements from

their isometric view using AutoCAD & mini drafter (Minimum 5 Drawings).

3.0   Engineering drawing of fastening elements in first angle orthographic

Projection
3.1 Bolt, nut and threads

3.2 Cotter joint

3.3 Knuckle joint

4.0   Details to assembly

4.1 Rigid pedestal bearing

4.2 Foot step bearing

4.3 Simple Screw jack

5.0   Assembly to details

5.1 Connecting rod of IC Engine

5.2 Boiler safety valve

5.3 Spring loaded valve

5.4 Hydraulic non return valve

5.5 Flat belt pulley

Learning Resources:

Sl No.	Author Name	Name of the Book	Publisher Name
1	N D Bhatt	Machine Drawing	Charotar
2	T Jones	Machine Drawing	Kalyani
3	R K Dhawan	Machine Drawing	S.Chand
4	T. Jeypooven	Emgg. Graphics using Autocad	CBS

MECHANICAL ENGINEERING LABORATORY (PRACTICAL-2)

Name of the Course: Diploma in **Mech/Auto/Aero & Other Mechanical Allied Branches**			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Lab. periods:	4 P/week	Sessional	25
Maximum marks:	75	End Semester Examination:	50

COURSE OBJECTIVES

Students will develop ability towards

- Conducting experimentations to determine properties of a solid material subject to uniaxial loading and impact
- Conducting experimentations towards determining characteristics of a fuel
- Study of equipment employing using fuels.

1. Strength of Materials and thermal Laboratory

1.1   Determine end reactions in a simply supported beam using parallel force apparatus.

1.2   Determination of Young's modulus using Searle's apparatus

1.3   Determination of torsional rigidity of the shaft using torsion testing machine

1.4   Determination of salient points (Young's modulus, yield point, fracture point) from

stress- strain curve using Universal Testing Machine

1.5   Determination of hardness number by Rockwell/Vickers hardness testing machine

1.6   Determination of toughness using Impact testing machine (Charpy/Izod)

1.7   Determination of Flash point and fire point

1.8   Joule's experiment

WORKSHOP PRACTICE-II (PRACTICAL-3)

Name of the Course: Diploma in **Mech/Auto/Aero & Other Mechanical Allied Branches**			
Course code:		Semester	3rd
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P/week	Sessional	50
Maximum marks:	100	End Semester Examination:	50

COURSE OBJECTIVES:-

Students will develop ability towards

- Practicing fitting, carpentry, smithy and machining
- Understanding the tools and equipment used in the practices
- Realize the time and resource utilization in the practices

1.   Fitting practices
1.1   Preparation of caliper
1.2   Preparation of try square
1.3   Preparation of hammer, square , Hexagonal

2.   Smithy Practices
2.1   Preparation of door ring with hook
2.2   Preparation of hexagonal head bolt
2.3   Preparation of octagonal flat chisel

3   Carpentry Practices
3.1   Cutting of slot, botch, mortise and Tenon Joint
3.2   Preparation of single dove tail joint

4   Welding Practice
4.1   Lap & Butt Joint using Arc Welding
4.2   Lap Joint using Gas Welding
4.3   Joining Two non-ferrous parts through

LIST OF EQUIPMENTS OF MECHANICAL ENGG. LABORATORY

Sl No	NAME OF THE EQUIPMENT	Quantity
1	PARALLEL FORCE APPARATUS	2 Nos.
2	SEARLE'S APPARATUS	2 Nos.
3	TORSION TESTING MACHINE	1 Nos.
4	DIGITAL UNIVERSAL TESTING MACHINE	1 Nos.
5	HARDNESS TESTING MACHINE	1 Nos.
6	IMPACT TESTING MACHINE	1 Nos.
7	FLASH POINT AND FIRE POINT APPARATUS	1 Nos.
8	JOULES APPARATUS	1 Nos.

LIST OF EQUIPMENTS OF WORKSHOP PRACTICE

WELDING SHOP

SL. NO.	NAME OF ITEM	QUANTITY
01	OXYGEN CYLINDER	01 No.
02	ACETYLENE CYLINDER	01 No.
03	PRESSURE GAUSES	02 Nos
04	PRESSURE REGULATOR	02 Nos.
05	WELDING TORCH	01 No.
06	GOGGLES	10 Nos.
07	HOSE PIPES	10 Meters
08	AC WELDING TRANSFORMER SET	01 No.
09	CHIPPING BRUSH	02 Nos.
10	WIRE BRUSH	02 Nos.
11	ARC SHIELD (EYE PROTECTOR)	05 Nos.
12	MIG / TIG WELDING MACHINE	01 Nos.

CARPENTRY SHOP

SL. NO.	NAME OF ITEM	QUANTITY
01	STEEL RULE (SCALE) 1 Meter	10 Nos.
02	SCRIBER	10 Nos.
03	MARKING GAUGE	05 Nos.
04	MORTISE GAUGE	05 Nos.
05	TRY SQURE	10 Nos.
06	DIVIDERS	10 Nos.
07	RIP SAW	10 Nos.
08	COPING SAW	10 Nos.
09	FIRMAR CHIESEL	10 Nos.
10	GAUGE CHIESEL	02 Nos.
11	IRON JACK PLANE	02 Nos.
12	TRYING PLANE	05 Nos.
13	RASP	05 Nos.
14	HAND DRILL	05 Nos.
15	GIMLET DRILL	02 Nos.
16	CLAMPING VICE	10 Nos.
17	C-CLAMP	05 Nos.
18	CROSS PEAN HAMMER	05 Nos.
19	CLAW HAMMER	10 Nos.
20	MALLET	05 Nos.
21	WOOD WORKING LATHE	01 No.
22	CIRCULAR SAW	01 No.

FITTING SHOP

SL. NO.	NAME OF ITEM	QUANTITY
01	BENCH VICE	20 Nos.
02	PIPE VICE	04 Nos.
03	TRY SQURE	10 Nos.
04	SCRIBER & SUEFACE GAUGE	10 Nos.
05	DOT PUNCH	10 Nos.
06	CENTRE PUNCH	10 Nos.
07	SURFACE PLATE	01 No.
08	ANGLE PLATE	01 No.
09	STEEL RULE	10 Nos.
10	VERNIER CALLIPERS	05 Nos.
11	MICROMETRE	05 Nos.
12	DIVIDERS	10 Nos.
13	OUTSIDE CALLIPERS	10 Nos.
14	INSIDE CALLIPERS	05 Nos.
15	FEELER GAUGE	01 No.
16	VERNIER HEIGHT GAUGE	01 No.
17	HACKSAW (FIXED FRAME)	10 Nos.
18	ROUND FILE	10 Nos.
19	SINGLE CUT FILE	10 Nos.
20	DOUBLE CUT FILE	10 Nos.
21	BALL PEAN HAMMER	05 Nos.
22	TAP WRENCH	01 No.
23	HAND DRILLING M/C	01 No.
24	PORTABLE GRINDER	01 o.

BLACKSMITHY SHOP

SL. NO.	NAME OF ITEM	QUANTITY
01	FURNACE OF HEARTH (WITH CENTRE BLOWER)	05 Nos.
02	SHOWEL	05 Nos.
03	POKER	05 Nos.
04	ANVIL	05 Nos.
05	SCEDGE HAMMER	05 Nos.
06	PICK UP TONG	10 Nos.
07	CHIESEL TONG	05 Nos.
08	CLOSE FLAT TONG	05 Nos.
09	PINUR TONG	05 Nos.
10	HOT CHIESEL	05 Nos.
11	COLD CHIESEL	05 Nos.
12	DRIFT	02 Nos.
13	SWAGE BLOCK	01 No.
14	BALL PEAN HAMMER	05 Nos.
15	CROSS PEAN HAMMER	05 Nos.

TEACHING AND EVALUATION SCHEME FOR 4th Semester (Mechanical Engg.) (wef. 2019-20)

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		Theory of Machine	4		-	20	80	3	100
Th.2		Manufacturing Technology	4		-	20	80	3	100
Th.3		Fluid Mechanics	4		-	20	80	3	100
Th.4		Thermal Engg-II	4		-	20	80	3	100
		Total	*16*			*80*	*320*	-	*400*
		Practical							
Pr.1		Theory of Machine and Measurement lab	-	-	6	25	75	3	100
Pr.2		Mechanical Engg. Lab-II	-	-	6	25	75	3	100
Pr.3		Workshop-III	-	-	6	50	50	4	100
Pr.4		Technical Seminar			2	50			50
		Student Centered Activities(SCA)		-	3				
		Total	-	-	23	150	200	-	350
		Grand Total	**16**	**-**	**23**	**230**	**520**	**-**	**750**

Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration

Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%

SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc. ,Seminar and SCA shall be conducted in a section.

CURRICULLUM OF 4th SEMESTER

For

DIPLOMA IN MECHANICAL ENGINEERING

(Effective FROM 2019-20 Sessions)
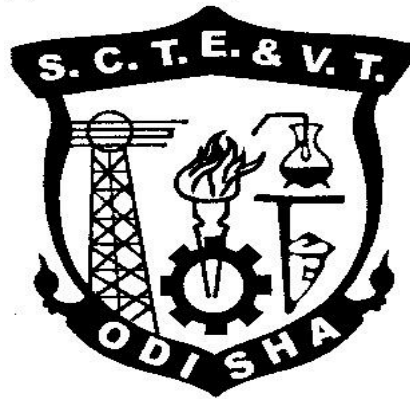
STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING, ODISHA, BHUBANESWAR

TH 1 - THEORY OF MACHINES

Name of the Course: Diploma in **Mech/Auto/ & Other Mechanical Allied Branches**			
Course code:		Semester	4th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

A.RATIONAL:

Mechanical and Automobile engineering is involved with design, manufacturing and use of various types of machines. Each machine consists of a large number of static and moving parts called mechanisms. Theory of machines is study of such different kind of mechanisms.

B.COURSE OBJECTIVES:
Students will develop an ability towards

- Understanding machine system consisting of different link assemblies as components
- Comprehending Working principle of machine components such as clutch, brakes, bearings based on friction
- Comprehending working principles related to power transmission systems and predicting the work involved and efficiency.
- Comprehending working principle in speed and torque regulating devices such as governor and flywheels
- Determination of amount and position of masses required towards static and dynamic balancing
- Comprehending types and causes of vibration in machines and predicting remedial measures

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
01	Simple Mechanism	08
02	Friction	12
03	Power Transmission	12
04	Governors and Flywheel	12
05	Balancing of Machine	08
06	Vibration of machine parts	08
	Total Period:	**60**

D. CONTENT

1.0   Simple mechanism
   1.1   Link ,kinematic chain, mechanism, machine
   1.2   Inversion, four bar link mechanism and its inversion
   1.3   Lower pair and higher pair
   1.4   Cam and followers

2.0   Friction
   2.1   Friction between nut and screw for square thread, screw jack
   2.2   Bearing and its classification, Description of roller, needle roller& ball bearings.
   2.3   Torque transmission in flat pivot& conical pivot bearings.
   2.4   Flat collar bearing of single and multiple types.
   2.5   Torque transmission for single and multiple clutches
   2.6   Working of simple frictional brakes.

3

2.7   Working of Absorption type of dynamometer

3.0   Power Transmission
    3.1   Concept of power transmission
    3.2   Type of drives, belt, gear and chain drive.
    3.3   Computation of velocity ratio, length of belts (open and cross)with and without slip.
    3.4   Ratio of belt tensions, centrifugal tension and initial tension.
    3.5   Power transmitted by the belt.
    3.6   Determine belt thickness and width for given permissible stress for open and crossed belt considering centrifugal tension.
    3.7   V-belts and V-belts pulleys.
    3.8   Concept of crowning of pulleys.
    3.9   Gear drives and its terminology.
    3.10   Gear trains, working principle of simple, compound, reverted and epicyclic gear trains.

4.0   Governors and Flywheel
    4.1   Function of governor
    4.2   Classification of governor
    4.3   Working of Watt, Porter, Proel and Hartnell governors.
    4.4   Conceptual explanation of sensitivity, stability and isochronisms.
    4.5   Function of flywheel.
    4.6   Comparison between flywheel &governor.
    4.7   Fluctuation of energy and coefficient of fluctuation of speed.
    4.8
5.0   Balancing of Machine
    5.1   Concept of static and dynamic balancing.
    5.2   Static balancing of rotating parts.
    5.3   Principles of balancing of reciprocating parts.
    5.4   Causes and effect of unbalance.
    5.5   Difference between static and dynamic balancing
6.0   Vibration of machine parts
    6.1   Introduction to Vibration and related terms (Amplitude, time period and frequency, cycle)
    6.2   Classification of vibration.
    6.3   Basic concept of natural, forced & damped vibration
    6.4   Torsional and Longitudinal vibration.
    6.5   Causes & remedies of vibration.

CHAPTERS COVERED UP TO IA- 1,2,3

Learning Resources:

Sl No.	Name of the Book	Author Name	Publisher
1.	Text Book of Theory of Machine	R.S Khurmi	S.Chand
2.	Text Book of Theory of Machine	R.K. Rajput	S.Chand
3.	Text Book of Theory of Machine	P.L.Ballany	Dhanpat Rai
4.	Text Book of Theory of Machine	Thomas Bevan	Pearsion

TH-2 MANUFACTURING TECHNOLOGY

Name of the Course: Diploma in **Mech/Auto/ & Other Mechanical Allied Branches**			
Course code:		Semester	4th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONAL:
Engineering basically means production of goods and services for human consumption. The major function of mechanical engineering is to manufacture various products using machineries, production processes and production management techniques. Therefore this is one of the most important subjects to be learned by a mechanical and automobile engineer.

B. COURSE OBJECTIVES:

Students will develop an ability towards

- Comprehending required material properties for cutting tools
- Comprehending machining mechanism principle and factors affecting machining performance
- Comprehendingworkingprincipleandcomponentsinmachiningtoolsincludinglathe,milling,shaping,planning,slottingmachines
- Comprehendingrequirementofsurfacefinishandrealizeprinciplesinvolvedingrindingandsuperfinishingoperations

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
01	Tool Materials	04
02	Cutting Tools	06
03	Lathe Machine	08
04	Shaper	06
05	Planning Machine	06
06	Milling Machine	08
07	Slotter	06
08	Grinding	06
09	Internal Machining operations	06
10	Surface finish, lapping	04
	Total Period:	**60**

D. CONTENT
1.0   Tool Materials
   1.1   Composition of various tool materials
   1.2   Physical properties& uses of such tool materials.

2.1 Cutting Tools
2.1 Cutting action of various and tools such as Chisel, hacksaw blade, dies and reamer
2.3 Turning tool geometry and purpose of tool angle
2.5 Machining process parameters (Speed, feed and depth of cut)
2.6 Coolants and lubricants in machining and purpose

3.0 Lathe Machine
3.1 Construction and working of lathe and CNC lathe
- Major components of a lathe and their function
- Operations carried out in a lathe(Turning, thread cutting, taper turning, internal machining, parting off, facing, knurling)
- Safety measures during machining

3.2 Capstan lathe
- Difference with respect to engine lathe
- Major components and their function
- Define multiple tool holders

3.3 Turret Lathe
- Difference with respect to capstan lathe
- Major components and their function

3.4 Draw the tooling layout for preparation of a hexagonal bolt &bush

4.0 Shaper
4.1 Potential application areas of a shaper machine
4.2 Major components and their function
4.3 Explain the automatic able feed mechanism
4.4 Explain the construction &working of tool head
4.5 Explain the quick return mechanism through sketch
4.6 State the specification of a shaping machine.

5.0 Planning Machine
5.1 Application area of a planer and its difference with respect to shaper
5.2 Major components and their functions
5.3 The table drive mechanism
5.4 Working of tool and tool support
5.5 Clamping of work through sketch.

6.0 Milling Machine
6.1 Types of milling machine and operations performed by them and also same for CNC milling machine

6.2 Explain work holding attachment
6.3 Construction & working of simple dividing head, universal dividing head
6.4 Procedure of simple and compound indexing
6.5 Illustration of different indexing methods

7.0 Slotter
7.1 Major components and their function
7.2 Construction and working of slotter machine
7.3 Tools used in slotter

8.0 Grinding
8.1 Significance of grinding operations
8.2 Manufacturing of grinding wheels
8.3 Criteria for selecting of grinding wheels
8.4 Specification of grinding wheels with
example Working of
- Cylindrical Grinder
- Surface Grinder
- Centreless Grinder

9.0 Internal Machining operations
Classification of drilling machines

    9.1   Working of
- Bench drilling machine
- Pillar drilling machine
- Radial drilling machine

    9.2   Boring
- Basic Principle of Boring
- Different between Boring and drilling

    9.3   Broaching
- Types of Broaching(pull type, push type)
- Advantages of Broaching and applications

10 Surface finish, lapping
    10.1   Definition of Surface finish
    10.2   Description of lapping& explain their specific cutting.

CHAPTERS COVERED UP TO IA- 1, 2,3,4,5

LearningResources:

Sl No.	Name of the Book	Author Name	Publisher
1.	Text Book of Workshop Technology	Hazra Choudhury Vol-I & II	MPP Pvt. Ltd.
2.	Text Book of Workshop Technology	W.A.S Chapman Vol-I & II	
3.	Text Book of Manufacturing Process	P.N Rao	TMH

TH-3 FLUID MECHANICS

Name of the Course: Diploma in **Mech & Other Mechanical Allied Branches**			
Course code:		Semester	4th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONAL:

Use of fluid in engineering field is of great importance. It is therefore necessary to study the physical properties and characteristics of fluids which have very important application in mechanical and automobile engineering.

B. COURSE OBJECTIVES:

Students will develop an ability towards

- Comprehending fluid properties and their measurements
- Realizing conditions for floatation
- Applying Bernoulli's theorem

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
01	Properties of Fluid	08
02	Fluid Pressure and its measurements	08
03	Hydrostatics	08
04	Kinematics of Flow	08
05	orifices, notches & weirs	08
06	Flow through pipe	10
07	Impact of jets	10
	Total Period:	**60**

D.CONTENT

1.0 Properties of Fluid
    1.1 Define fluid
    1.2 Description of fluid properties like Density, Specific weight, specific gravity, specific volume and solve simple problems.
    1.3 Definitions and Units of Dynamic viscosity, kinematic viscosity, surface tension Capillary phenomenon

2.0 Fluid Pressure and its measurements
    2.1 Definitions and units of fluid pressure, pressure intensity and pressure head.
    2.2 Statement of Pascal's Law.
    2.3 Concept of atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure
    2.4 Pressure measuring instruments
        Manometers (Simple and Differential)
            2.4.1 Bourdon tube pressure gauge(Simple Numerical)
    2.5 Solve simple problems on Manometer.

3.0 Hydrostatics

   3.1 Definition of hydrostatic pressure

   3.2 Total pressure and centre of pressure on
      immersed bodies(Horizontal and Vertical Bodies)

   3.3 Solve Simple problems.

   3.4 Archimedes 'principle, concept of buoyancy, meta center and meta centric height
      (Definition only)

   3.5 Concept of floatation

4.0 Kinematics of Flow

   4.1 Types of fluid flow

   4.2 Continuity equation(Statement and proof for one dimensional flow)

   4.3 Bernoulli's theorem(Statement and proof)
      Applications and limitations of Bernoulli's theorem (Venturimeter, pitot tube)

  4.4 Solve simple problems

5.0 Orifices, notches & weirs

   5.1 Define orifice

   5.2 Flow through orifice

   5.3 Orifices coefficient & the relation between the orifice coefficients

   5.4 Classifications of notches & weirs

   5.5 Discharge over a rectangular notch or weir

   5.6 Discharge over a triangular notch or weir

   5.7 Simple problems on above

6.0 Flow through pipe

   6.1   Definition of pipe.

   6.2   Loss of energy in pipes.

   6.3 Head loss due to friction: Darcy's and Chezy's formula (Expression only)

   6.4 Solve Problems using Darcy's and Chezy's formula.

   6.5 Hydraulic gradient and total gradient line

7.0 Impact of jets

   7.1 Impact of jet on fixed and moving vertical flat plates

   7.2 Derivation of work done on series of vanes and condition for maximum
      efficiency.

   7.3 Impact of jet on moving curved vanes, illustration using velocity triangles,
      derivation of work done, efficiency.

CHAPTERS COVERED UP TO IA- 1, 2,3,4

Learning Resources:

Sl No.	Name of the Book	Author Name	Publisher
1.	Text Book of Fluid Mechanics	R.K.Bansal	Laxmi
2.	Text Book of Fluid Mechanics	R.S khurmi	S.Chand
3.	Text Book of Fluid Mechanics	R.K.Rajput	S.Chand
4.	Text Book of Fluid Mechanics	Modi & Seth	Rajson's pub. Pvt. lt

THEORY 4 -THERMAL ENGINEERING-II

Name of the Course: Diploma in **Mech/ & Other Mechanical Allied Branches**			
Course code:		**Semester**	**4th**
Total Period:	60	**Examination**	3 hr
Theory periods:	4 P/week	**Class Test:**	20
Maximum marks:	100	**End Semester Examination:**	80

A. RATIONAL:

Modern society needs lots of applications of thermodynamics, which deals with energy possessed by hot vapors, its production and its application in different fields.

B. COURSE OBJECTIVES:

Student will develop ability towards.

- Understanding the power developed in I.C engine and efficiency.
- Understanding the principle, performance and application of air compressor.
- Determining thermodynamic properties of steam using steam tables & mollier chart.
- Comprehending the working of various steam generators i.e. boilers.
- Comprehending the vapor power cycles and computing work done & efficiencies thereof.

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
01	Performance of I. C engine	08
02	Air Compressor	12
03	Properties of steam	12
04	Steam Generator	12
05	Vapor power cycle	08
06	Heat Transfer	08
	Total Period:	**60**

D.CONTENT

1. **Performance of I.C engine**

    1.1 Define mechanical efficiency, Indicated thermal efficiency,

    Relative Efficiency, brake thermal efficiency overall efficiency

    Mean effective pressure &specific fuel consumption.

    1.2 Define air-fuel ratio & calorific value of fuel.

    1.3 Work out problems to determine efficiencies & specific fuel consumption.

2. Air Compressor

2.1 Explain functions of compressor & industrial use of compressor air

2.2 Classify air compressor & principle of operation.

2.3 Describe the parts and working principle of reciprocating Air compressor.

2.4 Explain the terminology of reciprocating compressor such as bore, stroke, pressure ratio free air delivered &Volumetric efficiency.

2.5 Derive the work done of single stage & two stage compressor with and without clearance.

2.6 Solve simple problems (without clearance only)

3. Properties of Steam

3.1 Difference between gas & vapours.

3.2 Formation of steam.

3.3 Representation on P-V, T-S, H-S, & T-H diagram.

3.4 Definition & Properties of Steam.

3.5 Use of steam table & mollier chart for finding unknown properties.

3.6 Non flow & flow process of vapour.

3.7 P-V, T-S & H-S, diagram.

3.8 Determine the changes in properties & solve simple numerical.

4. Steam Generator

4.1 Classification & types of Boiler.

4.2 Important terms for Boiler.

4.3 Comparison between fire tube & Water tube Boiler.

4.4 Description & working of common boilers (Cochran, Lancashire, Babcock & Wilcox Boiler)

4.5 Boiler Draught (Forced, induced & balanced)

4.6 Boiler mountings & accessories.

5. Steam Power Cycles

5.1 Carnot cycle with vapour.

5.2 Derive work & efficiency of the cycle.

5.3 Rankine cycle.

      5.3.1 Representation in P-V, T-S & h-s diagram.

      5.3.2 Derive Work & Efficiency.

      5.3.3 Effect of Various end conditions in Rankine cycle.

      5.3.4 Reheat cycle & regenerative Cycle.

5.4 Solve simple numerical on Carnot vapour Cycle & Rankine Cycle.

6. Heat Transfer

     6.1 Modes of Heat Transfer (Conduction, Convection, Radiation).

     6.2 Fourier law of heat conduction and thermal conductivity (k).

     6.3 Newton's laws of cooling.

     6.4 Radiation heat transfer (Stefan, Boltzmann & Kirchhoff's law) only statement, no derivation & no numerical problem.

     6.5 Black body Radiation, Definition of Emissivity, absorptivity, & transmissibility.

CHAPTERS COVERED UP TO IA- 1, 2,3.

Sl No.	Reference Book	Author Name	Publisher Name
1	Thermal Engineering	R.S. Khurmi	S.Chand
2	Thermal Engineering	A.R.Basu	Dhanpat Rai
3	Thermal Engineering	A.S. Sarao	Satya Prakash
4	Engineering Thermodynamics	P.k.Nag	TMH
5	Thermal Engineering	Mahesh M Rathore	TMH

PR-1   THEORY OF MACHINES AND MEASUREMENTS LAB

Name of the Course : Diploma in **Mech/ & Other Mechanical Allied Branches**

Course code:		Semester	4th
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P/W	Term Work	25
Maximum marks:	100	End Semester Examination:	75

SL. No   Content

1 Determination of centrifugal force of a governor (Hart Nell / Watt/Porter).

2 Study & demonstration of static balancing apparatus.

3 Study & demonstration of journal bearing apparatus.

4 Study of different types of Cam and followers.

5 Study & demonstration of epicyclic gear train.

6 Determination of the thickness of ground M.S flat to an accuracy of 0.02mm using Vernier Caliper.

7 Determination of diameter of a cylindrical component to an accuracy of 0.01mm using micrometer.

8. Determine the heights of gauge blocks or parallel bars to accuracy of 0.02mm using Vernier height gauge.

9. Determine the thickness of ground MS plates using slip gauges.

10. Determination of angel of Machined surfaces of components using sin bar with slip gauges.

PR- 2 MECHANICAL ENGG. LAB –II

Name of the Course: Diploma in **Mech/ & Other Mechanical Allied Branches**

Course code		Semester	4th
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P/W	Term Work	25
Maximum marks:	100	End Sem Examination:	75

SL. No	Content
1	Study of 2-S, 4-S petrol & diesel engine models
2	Determine the brake thermal efficiency of single cylinder petrol engine.
3	Determine the brake thermal efficiency of single cylinder diesel engine.
4	Determine the B.H.P, I.H.P BSFC of a multi cylinder engine by Morse test.
5	Determine the mechanical efficiency of an air Compressor.
6	Study of pressure measuring devices (manometer, Bourdon tube pressure gauge)
7	Verification of Bernoulli's theorem
8	Determination of Cd from venturimeter
9	Determination of Cc, Cv, Cd from orifice meter
10	Determine of Darcy's coefficient from flow through pipe

PR-3 WORKSHOP   PRACTICE-III

Name of the Course: Diploma in **Mech/ & Other Mechanical Allied Branches**			
Course code:		Semester	4th
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P/W	Teamwork	50
Maximum marks:	100	End Semester Examination:	50

Course Objectives:
Students will develop an ability towards

- Preparing components and jobs using foundry, welding and machining
- Realizing process parameters involved and their effects

1   **Machining Practices**

1.1   Job in evolving drilling, boring

1.2   Internal/External threading on Turning jobs

1.3   Job in evolving use of Capstan and turret lathe
        (Taper Turning & Chamfering)

1.4   All gear lathe, CNC Lathe Trainer Practice
        Job involving all turning process on MS Rod &
        aluminum rod for jobs using CNC Lathe trainer.

2   **Metal Machining**

2.1   Shaper
        Preparation of V Block on CI or MS Blocks

2.2   Milling Machine
        Preparation of Spur gear on CI or MS round

Pr4. TECHNICAL SEMINAR

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	4th
Total Period:	30		
Lab. periods:	02/week	Term Work	50
Maximum marks:	50		

OBJECTIVES:

Each student has to select a recent topic of latest technology in the area of Mechanical Engineering and present a seminar in front of all students of the class. He/She has to prepare a PowerPoint presentation of the selected topic of minimum 10 slides are the total presentation will be approximately 10 minutes duration .There will be interactive session between the presenter and rest of the students including the faculty members of the dept at the end of presentation .A student has to present at least 2 nos.of seminar during a semester and to submit the report for evaluation.

List of Equipments of Theory of Machine and Measurement Lab

Sl. No.	Name of Apparatus	QUANTITY
01	GOVERNOR APPARATUS	01No
02	STATIC AND DYNAMIC APPARATUS	01No
03	JOURNAL BEARING APPARATUS	01 No
04	CAM ANALYSIS APPARATUS	01 No
05	EPICYCLIC GEAR TRAIN	01 No
06	VERNIER CALLIPER	04 Nos.
07	MICROMETER	04 Nos.
08	VERNIER HEIGHT GAUGE	02 Nos.
09	SLIP GAUGE	02 Nos.
10	SINE BAR	02 Nos.

List of Equipments of Workshop Practice-III

Sl. No.	Name of Apparatus	QUANTITY
01	RADIAL DRILL MACHINE	01 No
02	ALL GEAR LATHE	06 Nos.
03	CAPSTAN LATHE	01 Nos.
04	CNC LATHE TRAINER	01 Nos.

List of Equipments of MEL-II

SL. NO.	NAME OF ITEM	QUANTITY
01	MODEL OF 2 STROKE PETROL ENGINE	02 Nos
02	MODEL OF 4 STROKE PETROL ENGINE	02 Nos.
03	MODEL OF 2 STROKE DIESEL ENGINE	02 Nos.
04	MODEL OF 4 STROKE DIESEL ENGINE	02Nos.
05	SINGLE CYLINDER PETROL ENGINE TEST RIG	01 No.
06	SINGLE CYLINDER DIESEL ENGINE TEST RIG	01 No.
07	MORSE TEST APPARATUS	01 No.
08	2 STAGE AIR COMPRESSOR TEST RIG	01 No.
09	PRESSURE MEASURING DEVICES (BOURDON TUBE PRESSURE GAUGE, MANOMETER)	02 Nos. each
10	BERNOULLI'S APPARATUS	01 No.
11	VENTURIMETER APPARATUS	01 No.
12	ORIFICEMETER APPARATUS	01 No
13	FLOW THROUGH PIPE APPARATUS	01 No

CURRICULLUM OF 5TH SEMESTER

For

DIPLOMA IN MECHANICAL ENGINEERING
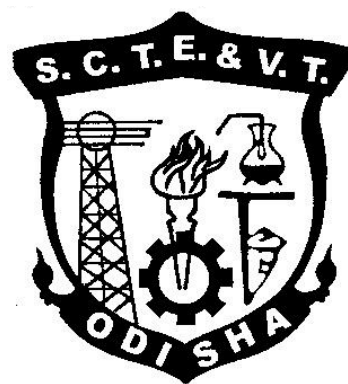
(Effective FROM 2020-21 Sessions)

STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING, ODISHA, BHUBANESWAR

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 5th Semester (Mechanical.) (wef 2020-21)

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		Entrepreneurship and Management & Smart Technology	4		-	20	80	3	100
Th.2		Design of Machine elements	4		-	20	80	3	100
Th.3		Hydraulic Machines &Industrial Fluid Power	4		-	20	80	3	100
Th.4		Mechatronics	4			20	80	3	100
Th.5		Refrigeration and air-conditioning	4			20	80	3	100
		Total	20			100	400	-	500
		Practical							
Pr.1		Refrigeration and Air conditioning lab	-	-	4	25	50	3	75
Pr.2		Hydraulic machines &Industrial Fluid power lab	-	-	4	25	50	3	75
Pr.3		CAD/CAM LAB	-	-	4	25	50	3	75
Pr.4		Project Work Phase -I		-	4	25	-	-	25
		Student Centered Activities (SCA)			3				
		Total	-	-	*19*	*100*	*150*	-	*250*
		Grand Total	**20**	**-**	**19**	**200**	**550**	**-**	**750**

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Abbreviations: L-Lecturer, T-Tutorial, P-Practical. Each class is of minimum 55 minutes duration

Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%

SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc. ,Seminar and SCA shall be conducted in a section.

There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester

</div>

Th1. ENTREPRENEURSHIP and MANAGEMENT & SMART TECHNOLOGY
(Common to All Branches)

Theory	4 Periods per week	Internal Assessment	20 Marks
Total Periods	60 Periods	End Sem Exam	80 Marks
Examination	3hours	Total Marks	100Marks

Topic Wise Distribution of Periods

SI No.	Topic	Periods
1	Entrepreneurship	10
2	Market Survey and Opportunity Identification(Business Planning)	8
3	Project report Preparation	4
4	Management Principles	5
5	Functional Areas of Management	10
6	Leadership and Motivation	6
7	Work Culture, TQM & Safety	5
8	Legislation	6
9	Smart Technology	6
	TOTAL	60

RATIONALE
In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students, so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mind set with managerial skill helps the student in the job market. The students can also be introduced with Startup and Smart Technology concept, which shall radically change the working environment in the coming days in the face of Industry 4.0
In this subject, the Students shall be introduced/ exposed to different concepts and Terminologies in brief only, so that he/she can have broad idea about different concepts/items taught in this subject. Solving numerical problem on any topic/item is beyond the scope of this subject.

OBJECTIVES
After undergoing this course, the students will be able to :
- Know about Entrepreneurship, Types of Industries and Startups
- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- know the management Principles and functional areas of management
- Inculcate leadership qualities to motivate self and others.
- Maintain and be a part of healthy work culture in an organisation.
- Use modern concepts like TQM
- Know the General Safety Rules
- Know about IOT and its Application in SMART Environment.

DETAILED CONTENTS

1. **Entrepreneurship**
   - Concept /Meaning of Entrepreneurship
   - Need of Entrepreneurship
   - Characteristics, Qualities and Types of entrepreneur, Functions
   - Barriers in entrepreneurship
   - Entrepreneurs vrs. Manager
   - Forms of Business Ownership: Sole proprietorship, partnership forms and others
   - Types of Industries, Concept of Start-ups
   - Entrepreneurial support agencies at National, State, District Level(Sources): DIC, NSIC,OSIC, SIDBI, NABARD, Commercial Banks, KVIC etc.
   - Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

2. **Market Survey and Opportunity Identification (Business Planning)**

   - Business Planning
   - SSI, Ancillary Units, Tiny Units, Service sector Units
   - Time schedule Plan, Agencies to be contacted for Project Implementation
   - Assessment of Demand and supply and Potential areas of Growth
   - Identifying Business Opportunity
   - Final Product selection

3. **Project report Preparation**

   - Preliminary project report
   - Detailed project report, Techno economic Feasibility
   - Project Viability

4. **Management Principles**
   - Definitions of management
   - Principles of management
   - Functions of management (planning, organising, staffing, directing and controlling etc.)
   - Level of Management in an Organisation

5. **Functional Areas of Management**
   a) Production management
      - Functions, Activities
      - Productivity
      - Quality control
      - Production Planning and control
   b) Inventory Management
      - Need for Inventory management
      - Models/Techniques of Inventory management
   c) Financial Management
      - Functions of Financial management
      - Management of Working capital
      - Costing (only concept)
      - Break even Analysis
      - Brief idea about Accounting Terminologies: Book Keeping, Journal entry, Petty Cash book, P&L Accounts, Balance Sheets(only Concepts)
   d) Marketing Management
      - Concept of Marketing and Marketing Management
      - Marketing Techniques (only concepts)
      - Concept of 4P s (Price, Place, Product, Promotion)
   e) Human Resource Management
   - Functions of Personnel Management
   - Manpower Planning, Recruitment, Sources of manpower, Selection process, Method of Testing, Methods of Training & Development, Payment of Wages

6. **Leadership and Motivation**
   a) Leadership

- Definition and Need/Importance
- Qualities and functions of a leader
- Manager Vs Leader
- Style of Leadership (Autocratic, Democratic, Participative)

b) Motivation
- Definition and characteristics
- Importance of motivation
- Factors affecting motivation
- Theories of motivation (Maslow)
- Methods of Improving Motivation
- Importance of Communication in Business
- Types and Barriers of Communication

7. **Work Culture, TQM & Safety**
- Human relationship and Performance in Organization
- Relations with Peers, Superiors and Subordinates
- TQM concepts: Quality Policy, Quality Management, Quality system
- Accidents and Safety, Cause, preventive measures, General Safety Rules , Personal Protection Equipment(PPE)

8. **Legislation**
a) Intellectual Property Rights(IPR), Patents, Trademarks, Copyrights
b) Features of Factories Act 1948 with Amendment (only salient points)
c) Features of Payment of Wages Act 1936 (only salient points)

9. **Smart Technology**
- Concept of IOT, How IOT works
- Components of IOT, Characteristics of IOT, Categories of IOT
- Applications of IOT- Smart Cities, Smart Transportation, Smart Home, Smart Healthcare, Smart Industry, Smart Agriculture, Smart Energy Management etc.

Syllabus to be covered before IA: Chapter 1,2,3,4

RECOMMENDED BOOKS

1. Entrepreneurship Development and Management by R.K Singhal, Katson Books., New Delhi
2. Entrepreneurship Development and Management by U Saroj and V Mahendiratta, Abhishek Publications, Chandigarh
3. Entrepreneurship Development and Management by Vasant Desai, Himalaya Pub.House
4. Industrial Engineering and Management by O.P Khanna ,Dhanpat Rai and Sons
5. Industrial Engineering and Management by Banga and Sharma, Khanna Publications
6. Internet of Things by Jeeva Jose, Khanna Publications, New Delhi
7. Online Resource on Startups and other concepts
8. https://www.fundable.com/learn/resources/guides/startup

TH.2 DESIGN OF MACHINE ELEMENTS

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs.
Theory periods:	4 P/W	I.A:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Machine design is the art of planning or devising new or improved machines to accomplish specific purposes. Idea of design is helpful in visualizing, specifying and selection of parts and components which constitute a machine. Hence all mechanical engineers should be conversant with the subject.

B. COURSE OBJECTIVES

At the end of the course the students will be able to

1. Understanding the behaviours of material and their uses.
2. Understanding the design of various fastening elements and their industrial uses.
3. Understanding the different failures of design elements.
4. Understanding the change of design to accomplish the different field of applications.
5. Design shafts, keys, couplings required for power transmission.
6. Design closed coil helical spring

C. CHAPTER WISE DISTRIBUTION OF PERIORDS

Sl.No.	Topic	Periods
01	INTRODUCTION	12
02	DESIGN OF FASTENING ELEMENTS	12
03	DESIGN OF SHAFT AND KEYS	12
04	DESIGN OF COUPLING	12
05	DESIGN OF CLOSED COIL HELICAL SPRING	12
	TOTAL	60

D. COURSE CONTENTS

1.0 Introduction:

1.1 Introduction to Machine Design and Classify it.
1.2 Different mechanical engineering materials used in design with their uses and their mechanical and physical properties.
1.3 Define working stress, yield stress, ultimate stress & factor of safety and stress –strain curve for M.S & C.I.
1.4 Modes of Failure (By elastic deflection, general yielding & fracture)
1.5 State the factors governing the design of machine elements.
1.6 Describe design procedure.

2.0 Design of fastening elements:

2.1 Joints and their classification.
2.2 State types of welded joints .
2.3 State advantages of welded joints over other joints.
2.4 Design of welded joints for eccentric loads.
2.5 State types of riveted joints and types of rivets.
2.6 Describe failure of riveted joints.
2.7 Determine strength & efficiency of riveted joints.
2.8 Design riveted joints for pressure vessel.
2.9 Solve numerical on Welded Joint and Riveted Joints.

3.0 Design of shafts and Keys:

3.1 State function of shafts.
3.2 State materials for shafts.
3.3 Design solid & hollow shafts to transmit a given power at given rpm based on
    a) Strength: (i) Shear stress, (ii) Combined bending tension;
    b) Rigidity: (i) Angle of twist, (ii) Deflection, (iii) Modulus of rigidity
3.4 State standard size of shaft as per I.S.
3.5 State function of keys, types of keys & material of keys.
3.6 Describe failure of key, effect of key way.
3.7 Design rectangular sunk key considering its failure against shear & crushing.
3.8 Design rectangular sunk key by using empirical relation for given diameter of shaft.
3.9 State specification of parallel key, gib-head key, taper key as per I.S.
3.10 Solve numerical on Design of Shaft and keys.

4.0 Design of Coupling:

4.1 Design of Shaft Coupling
4.2 Requirements of a good shaft coupling
4.3 Types of Coupling.
4.4 Design of Sleeve or Muff-Coupling.
4.5 Design of Clamp or Compression Coupling.
4.6 Solve simple numerical on above.

5.0 Design a closed coil helical spring:

5.1 Materials used for helical spring.
5.2 Standard size spring wire. (SWG).
5.3 Terms used in compression spring.
5.4 Stress in helical spring of a circular wire.
5.5 Deflection of helical spring of circular wire.
5.6 Surge in spring.
5.7 Solve numerical on design of closed coil helical compression spring.

Syllabus covered up to I.A-Chapters 1,2 &3

LEARNING RESOURCES

SL.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHER
01	PANDYA AND SHAH	MACHINE DESIGN	CHAROTAR PP
02	R.S.KHURMI &J.K.GOPTA	A TEXT BOOK OF MACHINE DESIGN	S.CHAND
03	P.C.SHARMA &D.K AGRAWAL	A TEXT BOOK OF MACHINE DESIGN	S.K.KATARIYA
04	V.B.BHANDARI	DESIGNOF MACHINE ELEMENTS	TMH
05	S.MD.JALAUDEEN	DESIGN DATA BOOK	ANURADHA PUBLICATION

TH.3 HYDRAULIC MACHINES &INDUSTRIAL FLUID POWER

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	5TH
Total Period:	60	Examination	3 hrs.
Theory periods:	4 P/W	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Use of fluids can be realized by a group of machines called hydraulic machine and use of hydraulic control and pneumatic control system in automation and in earth movers.

B. COURSE OBJECTIVES:

At the end of the course the students will be able to

1.Distinguish the working principle of pumps and turbines
2.Explain the working of centrifugal pumps and gear pumps.
3.Compare pneumatic system with hydraulic system.
4.Draw pneumatic circuits for industrial application.
5.State the properties of hydraulic system.
6.Develop hydraulic circuit for machine tool operation.

C. CHAPTERWISE DISTRIBUTION OF PERIORDS.

SL.NO	TOPICS	PERIORDS
01	HYDRAULIC TURBINES	15
02	CENTRIFUGAL PUMPS	05
03	PNEUMATIC SYSTEM	20
04	HYDRAULIC SYSTEM	20
	TOTAL	60

D.COURSE CONTENTS

1.0 HYDRAULIC TURBINES.

1.1 Definition and classification of hydraulic turbines
1.2 Construction and working principle of impulse turbine.
1.3 Velocity diagram of moving blades, work done and derivation of various efficiencies of impulse turbine.
1.4 Velocity diagram of moving blades, work done and derivation of various efficiencies of Francis turbine.
1.5 Velocity diagram of moving blades, work done and derivation of various efficiencies of Kaplan turbine

1.6 Numerical on above

1.7 Distinguish between impulse turbine and reaction turbine.

2.0 CENTRIFUGAL PUMPS

2.1 Construction and working principle of centrifugal pumps

2.2 work done and derivation of various efficiencies of centrifugal pumps.

2.3 Numerical on above

3.0 RECIPROCATING PUMPS
.
3.1 Describe construction & working of single acting reciprocating pump.

3.2 Describe construction & working of double acting reciprocating pump.

3.3 Derive the formula foe power required to drive the pump (Single acting & double acting)

3.5 Define slip.

3.5 State positive & negative slip & establish relation between slip & coefficient of discharge.

3.6 Solve numerical on above

4.0 PNEUMATIC CONTROL SYSTEM

4.1Elements –filter-regulator-lubrication unit

4.2 Pressure control valves

4.2.1 Pressure relief valves

4.2.2 Pressure regulation valves

4.3 Direction control valves

4.3.1 3/2DCV,5/2 DCV,5/3DCV

4.3.2 Flow control valves

4.3.3. Throttle valves

4.4 ISO Symbols of pneumatic components

4.5. Pneumatic circuits

4 .5.1 Direct control of single acting cylinder

4.5.2 Operation of double acting cylinder

4.5.3   Operation of double acting cylinder with metering in and metering out control

5.0 HYDRAULIC CONTROL SYSTEM

5.1 Hydraulic system, its merit and demerits

5.2 Hydraulic accumulators

5.3.1 Pressure control valves

5. 3.2 Pressure relief valves

5.3.3 Pressure regulation valves

5.3 Direction control valves

5.3.1   3/2DCV,5/2 DCV,5/3DCV

5.3.2   Flow control valves

5.3.3 Throttle valves

5.4 Fluid power pumps

       5.4.1 External and internal gear pumps

       5.4.2 Vane pump

       5.4.3 Radial piston pumps

5.5 ISO Symbols for hydraulic components.

5.6 Actuators

5.7 Hydraulic circuits

       5.7.1   Direct control of single acting cylinder

       5.7.2   Operation of double acting cylinder

       5.7.3   Operation of double acting cylinder with metering in and metering out control

5.8 Comparison of hydraulic and pneumatic system

Syllabus to be covered up to I.A –CHAPTER 1.,2, &3

LEARNING RESOURCES

SL.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHER
01	DR.JAGDISH LAL	HYDRAULIC MACHINES	METROPOLITAN BOOK CO
02	ANDREW	HYDRAULICS	
03	K SHANMUGA, SUNDARAM	HYDRAULIC &PNEUMATIC CONTROL	S.CHAND
04	MAJUMDAR	HYDRAULIC &PNEUMATIC CONTROL	TMH
05	J.F. BLACKBURN, G.REETHOF &J.L SHEARER	FLUID POWER CONTROL	

TH.4 MECHATRONICS

Name of the Course: Diploma in Mechanical Engg.			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs.
Theory periods:	4 P/W	I.A:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Day by day, engineering and technology experiences a tremendous growth. Mechatronics plays a major role in developing engineering and technology. It can be defined as the applications of electronics and computer technology to control the motions of mechanical systems. With the help of microelectronics and sensor technology, mechatronics systems are providing high levels of precision and reliability.

B. COURSE OBJECTIVES:

At the end of the course the students will be able to

1. To study the definition and elements   of mechatronics system.
2. To learn how to apply the principle of mechatronics for the development of productive systems.
3. To learn the CNC technology and applications of mechatronics in manufacturing automation.
4. Define different type of system and Sensors and solve the simple problems.
5. Explain the concept of Mechanical actuation, Electrical actuation and solve the simple problems.
6. Find out the various types of System Models & Input /Output parts and solve the problems.
7. Describe the programmable Logic Controller and develop programme in PLC.
8. To learn the Industrial robotics

C. CHAPTERWISE DISTRIBUTION OF PERIORDS

Sl No.	Topic	Periods
01	Introduction to Mechatronics	05
02	Sensors and Transducers	10
03	Actuators-Mechanical, Electrical	10
04	Programmable logic controllers	15
05	Elements of CNC Machines	15
06	Robotics	05

D.COURSE CONTENTS

1.0 INTRODUCTION TO MECHATRONICS

1.1 Definition of Mechatronics

1.2 Advantages & disadvantages of Mechatronics

1.3 Application of Mechatronics

1.4 Scope of Mechatronics in Industrial Sector

1.5 Components of a Mechatronics System

1.6 Importance of mechatronics in automation

2.0 SENSORS AND TRANSDUCERS

2.1 Defination of Transducers

2.2 Classification of Transducers

2.3 Electromechanical Transducers

2.4 Transducers Actuating Mechanisms

2.5 Displacement &Positions Sensors

2.6 Velocity, motion, force and pressure sensors.

2.7 Temperature and light sensors.

3.0 ACTUATORS-MECHANICAL, ELECTRICAL

3.1 Mechanical Actuators

3.1.1 Machine, Kinematic Link, Kinematic Pair

3.1.2 Mechanism,   Slider crank Mechanism

3.1.3 Gear Drive, Spur gear, Bevel gear, Helical gear, worm gear

3.1.4 Belt & Belt drive

3.1.5 Bearings

3.2 Electrical Actuator

3.2.1 Switches and relay

3.2.2 Solenoid

3.2.3 D.C Motors

3.2.4 A.C Motors

3.2.5 Stepper Motors

3.2.6 Specification and control of stepper motors

3.2.7 Servo Motors D.C & A.C

4.0 PROGRAMMABLE LOGIC CONTROLLERS(PLC)

4.1 Introduction

4.2 Advantages of PLC

4.3 Selection and uses of PLC

4.4 Architecture basic internal structures

4.5 Input/output Processing and Programming

4.6 Mnemonics

4.7 Master and Jump Controllers

5.0 ELEMENTS OF CNC MACHINES

5.1 Introduction to Numerical Control of machines and CAD/CAM

5.1.1 NC machines

5.1.2 CNC machines

5.1.3.CAD/CAM

5.1.3.1 CAD

5.1.3.2 CAM

5.1.3.3 Software and hardware for CAD/CAM

5.1.3.4 Functioning of CAD/CAM system

5.1.3.4 Features and characteristics of CAD/CAM system

5.1.3.5 Application areas for CAD/CAM

5.2 elements of CNC machines

5.2.1 Introduction

5.2.2 Machine Structure

5.2.3 Guideways/Slide ways

5.2.3.1 Introduction and Types of Guideways

5.2.3.2 Factors of design of guideways

5.2.4 Drives

5.2.4.1 Spindle drives

5.2.4.2 Feed drive

5.2.5 Spindle and Spindle Bearings

6.0 **ROBOTICS**

6.1 Definition, Function and laws of robotics

6.2Types of industrial robots

6.3 Robotic systems

6.4 Advantages and Disadvantages of robots

Syllabus to be covered up to 1st I.A : Chapters 1,2,3 & 4

LEARNING RESOURCES:

SL.NO.	AUTHOR	TITLE OF THE BOOK	PUBLISHER
1	W. Bolton	Mechatronics	Pearson Education India
2	R.K Rajput	Text book of Mechatronics	S. Chand
3	R. RADHAKRISHNA, S,SUBRAMANIAN	CAD/CAM/CIM	NEW AGE INTERNATIONAL PVT.LTD
4	MIKELL GROVER	CAD/CAM	

Th.5   REFRIGERATION AND AIR CONDITIONING

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	I.A:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Food Preservation is the basic need of food industry to improve effective utilization of food. Hence the study of Refrigeration and Air-conditioning is essential. Comfort is the basic requirement of customers and machines through air conditioning & hence learning the concept of air-conditioning and methods of air-conditioning   facilities quality design of air conditioning.

B. COURSE OBJECTIVE:

At the end of the course the students will be able to

1. Explain the working of open & closed air system of air refrigeration system

2. Describe the working and construction of compressor, Condenser, evaporator, expansion valve used for air conditioning and refrigeration.

3. Explain Vapor Compression refrigeration system.

4. Explain Vapor Absorption refrigeration system.

5. Compare different refrigerants properties.

6. Describe equipment for air conditioning.

7. Explain the cooling load for the given requirement.

C. CHAPTER WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods
01	**AIR REFRIGERATION CYCLE**	05
02	**SIMPLE VAPOUR COMPRESSION REFRIGERATION SYSTEM**	10
03	**VAPOUR ABSORPTION REFRIGERATION SYSTEM**	07
04	**REFRIGERATION EQUIPMENTS**	08
05	**REFRIGERANT FLOW CONTROLS, REFRIGERANTS & APPLICATION OF REFRIGERANTS**	10
06	**PSYCHOMETRICS &COMFORT AIR CONDITIONING SYSTEMS**	10
07	**AIR CONDITIONING SYSTEMS**	10
	TOTAL	60

D.COURSE CONTENTS

1.0 AIR REFRIGERATION CYCLE.
1.1 Definition of refrigeration and unit of refrigeration.
1.2 Definition of COP, Refrigerating effect (R.E)
1.3 Principle of working of open and closed air system of refrigeration.
  1.3.1 Calculation of COP of Bell-Coleman cycle and numerical on it.

2.0 SIMPLE VAPOUR COMPRESSION REFRIGERATION SYSTEM
2.1 schematic diagram of simple vapors compression refrigeration system'
2.2 Types
2.2.1 Cycle with dry saturated vapors after compression.
2.2.2 Cycle with wet vapors after compression.
2.2.3 Cycle with superheated vapors after compression.
2.2.4 Cycle with superheated vapors before compression.
2.2.5 Cycle with sub cooling of refrigerant
2.2.6 Representation of above cycle on temperature entropy and pressure enthalpy diagram
2.2.7 Numerical on above (determination of COP,mass flow)

3.0 VAPOUR ABSORPTION REFRIGERATION SYSTEM
3.1 Simple vapor absorption refrigeration system
3.2 Practical vapor absorption refrigeration system
3.3 COP of an ideal vapor absorption refrigeration system
3.4.Numerical on COP.

4.0 REFRIGERATION EQUIPMENTS

4.1 REFRIGERANT COMPRESSORS
4.1.1 Principle of working and constructional details of reciprocating and rotary compressors.

4.1.2 Centrifugal compressor only theory

4.1.3 Important terms.

4.1.4 Hermetically and semi hermetically sealed compressor.

4.2 CONDENSERS
4.2.1 Principle of working and constructional details of air cooled and water cooled condenser
4.2.2 Heat rejection ratio.
4.2.3 Cooling tower and spray pond.

4.3 EVAPORATORS
1.6.1 Principle of working and constructional details of an evaporator.
1.6.2 Types of evaporator.
1.6.3 Bare tube coil evaporator, finned evaporator, shell and tube evaporator.

5.0 REFRIGERANT FLOW CONTROLS, REFRIGERANTS & APPLICATION OF REFRIGERANTS

5.1 EXPANSION VALVES
5.1.1 Capillary tube

5.1.2 Automatic expansion valve

5.1.3 Thermostatic expansion valve

5.2 REFRIGERANTS

5.2.1 Classification of refrigerants

5.2.2 Desirable properties of an ideal refrigerant.

5.2.3 Designation of refrigerant.

5.2.4 Thermodynamic Properties of Refrigerants.

5.2.5 Chemical properties of refrigerants.

5.2.6 commonly used refrigerants, R-11, R-12, R-22, R-134a, R-717

5.2.7 Substitute for CFC

5.3 Applications of refrigeration

5.3.1 cold storage

5.3.2 dairy refrigeration

5.3.3 ice plant

5.3.4 water cooler

5.3.5 frost free refrigerator

6.0 PSYCHOMETRICS &COMFORT AIR CONDITIONING SYSTEMS

6.1 Psychometric terms

6.2 Adiabatic saturation of air by evaporation of water

6.3 Psychometric chart and uses.

6.4 Psychometric processes

6.4.1 Sensible heating and Cooling

6.4.2 Cooling and Dehumidification

6.4.3 Heating and Humidification

6.4.4 Adiabatic cooling with humidification

6.4.5 Total heating of a cooling process

6.4.6 SHF, BPF,

6.4.7 Adiabatic mixing

6.4.8 Problems on above.

6.5 Effective temperature and Comfort chart

7.0 AIR CONDITIONING SYSTEMS

7.1 Factors affecting comfort air conditioning. .
7.2 Equipment used in an air-conditioning.
7.3 Classification of air-conditioning system
7.4 Winter Air Conditioning System
7.5 Summer air-conditioning system.
7.6 Numerical on above

Syllabus to be covered up to I.A-   Chapters1.2&3.

LEARNING RESOURCES

SL.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHER
01	C.P ARRORA	REFRIGERATION AND AIR CONDITIONING	TMH
02	R.S.KHURMI &J.K.GOPTA	REFRIGERATION AND AIR CONDITIONING	S.CHAND
03	P.L BALLANY	REFRIGERATION AND AIR CONDITIONING	KHANNA PUBLISHER
04	DOMKUNDRA AND ARORA	REFRIGERATION AND AIR CONDITIONING	DHANPAT RAY AND SONS

Pr.1 REFRIGERATION AND AIR CONDITIONING LAB

Name of the Course: Diploma in Mechanical Engg.			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Sessional:	25
Maximum marks:	100	End Semester Examination:	50

COURSE OBJECTIVES

At the end of the course the students will be able to

1.Study the construction features of Domestic Refrigerator, water cooler, Window Air Conditioner, Split Air Conditioner

2.Determining the capacity, COP, of Refrigerator Test Rig, Window air Conditioner, Split Air Conditioner, Water cooler.

3.Evacuating the entire system

4.Locating the leakage in refrigerating system

5.Charging of the refrigerating system

List of Practicals

1. Study the construction features of Domestic Refrigerator.

2. Study the construction features of water cooler.

3. Study the construction features of window air conditioner

4. Study the construction features of split air conditioner

5.Determine the capacity and cop of vapour compression Refrigerator test rig

6.Determine the capacity and cop of water cooler

7.Determine the capacity and cop of window air conditioner

8.Determine the capacity and cop of split air conditioner

9. Determine the capacity and cop of vapour absorption Refrigerator test rig.

10.Complete charging of a domestic refrigerator and its leak test.

Pr 2. HYDRAULIC MACHINES &INDUSTRIAL FLUID POWER LAB

Name of the Course: Diploma in Mechanical Engg.			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs.
Theory periods:	4 P/W	Sessional:	25
Maximum marks:	100	End Semester Examination:	50

COURSE OBJECTIVES

At the end of the course the students will be able to

1.0 Conducting performance test on impulse and reaction turbine

2.0 Conducting performance test on centrifugal pump

3.0 Designing &operating pneumatic circuits

4.0 Designing &operating industrial fluid power circuits

List of Practicals

1.0 Performance test on impulse turbine and to find out the efficiency

2.0 Performance test on Kaplan turbine and to find out the efficiency

3.0 Performance test on Francis turbine and to find out the efficiency

4.0 Performance test on centrifugal pump and to find out the characteristic curves

5.0 Direct operation of single &double acting pneumatic cylinder.

6.0 Operating double acting pneumatic cylinder with quick exhaust valve

7.0 Speed control double acting pneumatic cylinder using metering in and metering out circuits.

8.0 Direct operation of single &double acting hydraulic cylinder

9.0 Direct operation of hydraulic motor

10.0   Speed control double acting hydraulic cylinder using metering in & metering out circuits.

Pr.3   CAD/CAM LAB

Name of the Course: Diploma in Mechanical Engg.			
Course code:		Semester	5th
Total Period:	60	Examination	3 Hrs
Theory periods:	4 P/W	Sessional:	25
Maximum marks:	75	End Semester Examination:	50

OBJECTIVES

At the end of the course the students will be able to

1. To understand the fundamentals and use of CAD.

2. To conceptualize drafting and modelling in CAD.

3. To interpret the various features in the menu of solid modelling package.

4. To synthesize various parts or components in an assembly.

5. Toprepare CNC programmes for various jobs

COURSE CONTENTS

PART-A.

INTRODUCTION:

Part modelling, Datum plane, Datum plane; constraint; dimensioning; extrude; revolve; sweep; protrusion; extrusion; rib; shell; hole; round; chamfer; copy; mirror; assembly; align; orient.

EXERCISES:

2D Drawings of Rectangle, circle, polygon and its dimensioning

3D Drawings of;

1. Gib and cutter joint

2. Screw Jack;

3. Connecting Rod;

4. Bearing Block.

Print the orthographic view from the above assembled 3Ddrawing

PART-B.

CNC Programming and Machining

INTRODUCTION;

1. Study of CNC lathe, milling;

2. Study of international codes; G-Codes and M –Codes

3. Format –Dimensioning methods;

4. Programme writing –Turning Simulator-Milling simulator IS practice-commands menus

5. Editing the programme in the CNC MACHINES;

6. Execute the programme in the CNC machines;

Exercise;

1. Print the programme and make the component in the CNC machine;

2. Using canned cycle-create a part programme for thread cutting, grooving and produce component in the CNC Turning Machine

3. Using Linear interpolation and Circular Interpolation-Create a part programme for grooving and produce component in the CNC Milling Machine

Pr 4. PROJECT WORK (Phase-I)

Course code:		Semester	5th
Total Period:	60	Examination :	-
Theory periods:	4P / week	Sessional Marks	25
		TOTAL Marks	25

RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of mechanical engineering practices in real life situations, so as to participate and manage a large mechanical engineering projects in future. _Entire Project shall spread over 5th and 6th Semester_. Part of the Project covered in 5th Semester shall be named as _Project Phase-I_ and balance portion to be covered in 6th Semester shall be named as _Project Phase-II_.

OBJECTIVES
After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real life working environment, preferably in an industrial environment.
- Develop working models or applications and implement these for the actual needs of the community/industry.
- Explain the working of industrial environment and its work ethics.
- Explain what entrepreneurship is and how to become an entrepreneur.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- Find latest ideas on robotics, automation and mechatronics based projects.

General Guidelines
The individual students have different aptitudes and strengths and also areas of interest. Project work, therefore, should match the strengths and interest of the students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (right from beginning of 5th semester). Students should be allotted a problem of interest to him/her as a project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. Preferably there should not be more than 5 students, if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

Following are the broad suggestive areas of project work

- ✓ Automobile based projects.
- ✓ Refrigeration based &Air conditioning based projects.
- ✓ Hydraulic control &Pneumatic control based automation projects
- ✓ Fabrication based projects.
- ✓ Wind mill
- ✓ Solar energy based projects.
- ✓ Thermal power plant using steam.
- ✓ Hydel power dam.
- ✓ Cooling tower.

- ✓ Solenoid based hammer.
- ✓ Unmanned railway crossing.
- ✓ Engine based air compressor.
- ✓ Mobile all round year air conditioner
- ✓ Driverless car.
- ✓ Hybrid motorbike.
- ✓ Any other areas found suitable.
- ✓ Torque testing machine.
- ✓ Spring testing machine.
- ✓ Mechanical sanitizer.
- ✓ Solar powered refrigerator.
- ✓ Door opener.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	Performance Criteria
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations to such an exhibition.

Project Phase-I and Phase-II

The Project work duration shall cover 2 semesters(5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group shall be done in the beginning of 5th sem under Project Phase-I. The students may be allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work upto Design of the system have to be complete in Phase-I. Execution of work may begin in Phase-I depending on the Project. Project Milestones are to be set so that progress can be tracked . In Phase-II Execution of work and Documentation have to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the components of Task and schedule.

At the end of Project Phase-I in 5th semester there shall be one presentation by each group to mark to progress and also to judge whether the Project is moving in right direction as per the objective of the Project.

EQUIPMENT LIST

REFRIGERATION AND AIR –CONDITIONING LAB

SL.NO	NAME OF THE EQUIPMENTS	QUANTITY
01	Domestic Refrigerator test rig	01 no
02	water cooler test rig	01 no
03	Window Air Conditioner test rig	01 no
04	Split Air Conditioner test rig	01 no
05	Vacuum pump set with accessories	01 no
06	Charging cylinder with accessories	02 nos
07	Halide torch or any leak tester	02 nos
08	Vapour absorption test rig	01

HYDRAULIC MACHINES & INDUSTRIAL FLUID POWER LAB

| SL.NO	NAME OF THE EQUIPMENTS	QUANTITY
01	Impulse turbine(PELTON WHEEL) Test Rig with arrangements to find efficiency	01no
02	Kaplan turbine Test Rig with arrangements to find efficiency	01no
03	Francis turbine Test Rig with arrangements to find efficiency	01no
04	Centrifugal pump Test Rig with arrangements to find efficiency	01no
05	Pneumatic Trainer Kit with accessories	02nos
06	Hydraulic Trainer Kit with accessories	01no
07	Manual or Digital Tachometer	05nos

CAD/CAM LAB

SL.NO	NAME OF THE EQUIPMENTS	QUANTITY
01	DESKTOP COMPUTER with UPS	30 no
02	AUTOCAD SOFTWARE 2D/3D	01 each
03	CNC TURNING MACHINE	01 no
04	CNC MILLING MACHINE	01 no
05	PRINTER	02 nos

CURRICULLUM OF 6TH SEMESTER

For

DIPLOMA IN MECHANICAL ENGINEERING
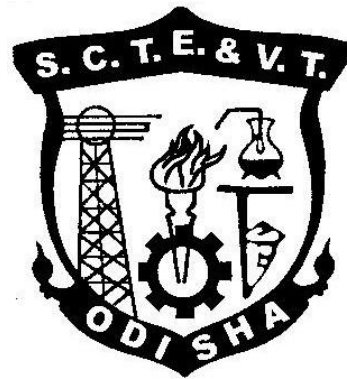
(Effective FROM 2020-21 Sessions)

STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING, ODISHA, BHUBANESWAR

		STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA						
		TEACHING AND EVALUATION SCHEME FOR 6th Semester (Mechanical Engg.) (wef 2020-21)						
Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		INDUSTRIAL ENGINEERING & MANAGEMENT	4		-	20	80	3	100
Th.2		AUTOMOBILE ENGINEERING AND HYBRID VEHICLES	4		-	20	80	3	100
Th.3		POWER STATION ENGINEERING	4		-	20	80	3	100
Th.4		ELECTIVE (any One)	4			20	80	3	100
Th.4(a)		COMPOSITE MATERIALS							
Th.4(b)		ADVANCE MANUFACTURING PROCESSES							
Th.4(c)		INDUSTRIAL ROBOTICS & AUTOMATION							
		Total	**16**			**80**	**320**	**-**	**400**
		Practical							
Pr.1		AUTOMOBILE ENGINEERING LAB	-	-	4	50	50	3	100
Pr.2		POWER STATION ENGINEERING LAB	-	-	4	25	50	3	75
Pr.3		PROJECT WORK PHASE -II		-	10	50	100	3	150
Pr.4		LIFE SKILL	-	-	2	25	-	-	25
		STUDENT CENTERED ACTIVITIES (SCA)			3				
		Total	**-**	**-**	**23**	**150**	**200**	**-**	**350**
		Grand Total	**16**	**-**	**23**	**230**	**520**	**-**	**750**
		Abbreviations: L-Lecturer, T-Tutorial, P-Practical. Each class is of minimum 55 minutes duration							
		Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%							
		SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM /Idea Tinkering and Innovation Lab Practice etc. ,Seminar and SCA shall be conducted in a section.							
		There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester							

TH1. INDUSTRIAL ENGINEERING & MANAGEMENT

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Internal assessment	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Main objective of Mechanical Engineering is to produce goods and services for benefit to mankind. Such productions are done utilizing various resources like Men, Materials, machines and Money. Industrial engineering and quality control is the subject which allows optimized use of such resources and hence very important for a mechanical engineer.

B. COURSE OBJECTIVES:

After undergoing this course, the students will be able to:

1.Identify the place for a new plant set up and systematic arrangement of machinery and shop for smooth production.

2.Take right decisions to optimize resources utilizations by improving productivity of the lands ,buildings,people,material,machines,money,methods and management effectively.

3.Understanding of stock management and maintenance to reduce plant ideal time.

4 To use the charts to record the quality of products.

5.To eliminate unproductive activities under the control of the management, supervisor, worker and the design of products and processes.

C. CHAPTER WISE DISTRIBUTION OF PERIORDS

Sl No.	Topic	Periods
1	**PLANT ENGINEERING**	10
2	**OPERATIONS RESEARCH**	10
3	**INVENTORY CONTROL**	10
4	**INSPECTION AND QUALITY CONTROL**	15
5	**PRODUCTION PLANNING AND CONTROL**	15

D. COURSE CONTENT

1. PLANT ENGINEERING:

1.1 Selection of Site of Industry.

1.2 Define plant layout.

1.3 Describe the objective and principles of plant layout.

1.4 Explain Process Layout, Product Layout and Combination Layout.

1.5 Techniques to improve layout.

1.6 Principles of material handling equipment.

1.7 Plant maintenance.

1.7.1 Importance of plant maintenance.
1.7.2 Break down maintenance.
1.7.3 Preventive maintenance.
1.7.4 Scheduled maintenance.

2. OPERATIONS RESEARCH:
2.1 Introduction to Operations Research and its applications.
2.2 Define Linear Programming Problem,
2.3 Solution of L.P.P. by graphical method.
2.4 Evaluation of Project completion time by Critical Path Method and PERT (Simple problems)-
2.5 Explain distinct features of PERT with respect to CPM.

3. INVENTORY CONTROL:
3.1 Classification of inventory.
3.2 Objective of inventory control.
3.3 Describe the functions of inventories.
3.4 Benefits of inventory control.
3.5 Costs associated with inventory.
3.6 Terminology in inventory control
3.7 Explain and Derive economic order quantity for Basic model. (Solve numerical)
3.8 Define and Explain ABC analysis.

4. INSPECTION AND QUALITY CONTROL:
4.1 Define Inspection and Quality control.
4.2 Describe planning of inspection.
4.3 Describe types of inspection.
4.4 Advantages and disadvantages of quality control.
4.5 Study of factors influencing the quality of manufacture.
4.6 Explain the Concept of statistical quality control, Control charts (X, R, P and C - charts).
4.7 Methods of attributes.
4.8 Concept of ISO 9001-2008.
4.9.1 Quality management system, Registration /certification procedure.
4.9.2 Benefits of ISO to the organization.
4.9.3 JIT, Six sigma,7S, Lean manufacturing
4.9.4 Solve related problems.

5.0 PRODUCTION PLANNING AND CONTROL
5.1 Introduction
5.2 Major functions of production planning and control
5.3 Methods of forecasting
5.3.1 Routing
5.3.2 Scheduling
5.3.3 Dispatching
5.3.4 Controlling
5.4 Types of production
5.4.1 Mass production
5.4.2 Batch production
5.4.3 Job order production
5.5 Principles of product and process planning.

Syllabus to be covered before IA: Chapter 1,2,3

Learning Resources:			
Sl. No.	*Name of Authors*	*Title of the Book*	*Name of the Publisher*
1	O.P.KHANNA	INDUSTRIAL ENGINEERING & MANAGEMENT	DHANPAT RAI & SONS
2	MARTAND TELSANG	INDUSTRIAL ENGG & PRODUCTION MANAGEMENT	S.CHAND
3	M.MAHAJAN	STATISTICAL QUALITY CONTROL	DHANPAT RAI &SONS
4			

TH.2 AUTOMOBILE ENGINEERING AND HYBRID VEHICLES

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Internal assessment	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Automobiles are the principal mode of transport system. Their manufacture and maintenance gives a major scope for employment. Many entrepreneur pass outs go for servicing of automobiles or trading/ manufacturing of auto components. Thus automobile engineering is an important subject to be in the regular curriculum of the mechanical engineering.

B. COURSE OBJECTIVES:

At the end of the course the students will be able to:

* Understand automobile chassis, transmission, breaking and fuel system etc.
* Understand the basics of electric vehicle kinematics.
* Understand the concepts of hybrid electric vehicles.

C.TOPIC WISE DISTRIBUTION OF PERIODS

Sl No.	Topic	Periods
1	Introduction & Transmission System	12
2	Braking system	5
3	Ignition & Suspension System	10
4	Cooling and Lubrication	8
5	Fuel system	10
6	Hybrid and Electric Vehicles	15

C.COURSE CONTENTS

1.0 INTRODUCTION & TRANSMISSION SYSTEM:

1.1 Automobiles: Definition, need and classification: Layout of automobile chassis with major components (Line diagram)

1.2 Clutch System: Need, Types (Single & Multiple) and Working principle with sketch

1.3 Gear Box: Purpose of gear box, Construction and working of a 4 speed gear box

1.4 Concept of automatic gear changing mechanisms

1.5 Propeller shaft: Constructional features

1.6 Differential: Need, Types and Working principle

2.0 BRAKING SYSTEM:

2.1 Braking systems in automobiles: Need and types

2.2 Mechanical Brake

2.3 Hydraulic Brake

2.4 Air Brake

2.5 Air assisted Hydraulic Brake

2.6 Vacuum Brake

3.0 IGNITION & SUSPENSION SYSTEM:

3.1 Describe the Battery ignition and Magnet ignition system

3.2 Spark plugs: Purpose, construction and specifications

3.3 State the common ignition troubles and its remedies

3.4 Description of the conventional suspension system for Rear and Front axle

3.5 Description of independent suspension system used in cars (coil spring and tension bars)

3.6 Constructional features and working of a telescopic shock absorber

4.0 COOLING AND LUBRICATION:

4.1 Engine cooling: Need and classification

4.2 Describe defects of cooling and their remedial measures

4.3 Describe the Function of lubrication

4.4 Describe the lubrication System of I.C. engine

5.0 FUEL SYSTEM:

5.1 Describe Air fuel ratio

5.2 Describe Carburetion process for Petrol Engine

5.3 Describe Multipoint fuel injection system for Petrol Engine

5.4 Describe the working principle of fuel injection system for multi cylinder Engine 5.5 Filter for Diesel engine

5.6 Describe the working principle of Fuel feed pump and Fuel Injector for Diesel engine

6.0 ELECTRIC AND HYBRID VEHICLES:

6.1 Introduction, Social and Environmental importance of Hybrid and Electric Vehicles

6.2 Description of Electric Vehicles, operational advantages, present performance and applications of Electric Vehicles

6.3 Battery for Electric Vehicles, Battery types and fuel cells

6.4 Hybrid vehicles, Types of Hybrid and Electric Vehicles: Parallel, Series, Parallel and Series configurations;6.5 Drive train

6.6 Solar powered vehicles

D.SYLLABUS COVERED UP TO I.A-CHAPTERS 1,2 &3

E.LEARNING RESOURCES:			
Sl. No.	Name of Authors	Title of the Book	Name of the Publisher
1	R.B.Gupta	Automobile Engineering	Satya Prakashan
2	Dr Kirpal Singh	Automobile Engineering Vol- I & II	Standard Publishers
3	C.P.Nakra	Automobile Engineering	Dhanpat Rai Publication
4	W.H.Course	Automotive Engine	McGraw Hill
5	Iqbal Hussain	Electric & Hybrid Vehicles – Design Fundamentals	CRC Press, 2
6	A.K. Babu	Statistical Electric & Hybrid Vehicles	Khanna Publishing House, New Delhi, 2018

TH.3   POWER STATION ENGINEERING

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Internal assessment	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:
Bulk powers used in industries and for domestic purposes are generated in power stations. A large number of diverse and specialized equipment and system are used in a power plant should have this important subject in mechanical engineering.

B. COURSE OBJECTIVES:
At the end of the course the students will be able to:
- Understand the generation of power by utilizing various energy sources.
- Understand the use of steam, its operation in thermal power stations.
- Understand the nuclear energy sources and power developed in nuclear power station.
- Understand the basics of diesel electric power station and hydroelectric power station.
- Understand the basics of gas turbine power station
-

C.TOPIC WISE DISTRIBUTION OF PERIODS

Sl No.	Topic	Periods
1	**INTRODUCTION**	05
2	**THERMAL POWER STATIONS**	20
3	**NUCLEAR POWER STATIONS**	10
4	**DIESEL ELECTRIC POWER STATIONS**	10
5	HYDEL POWER STATIONS	10
6	GAS TURBINE POWER STATIONS	05

D.COURSE CONTENTS:
1.0 INTRODUCTION:
1.1 Describe sources of energy.
1.2 Explain concept of Central and Captive power station.
1.3 Classify power plants.
1.4 Importance of electrical power in day today life.
1.5 Overview of method of electrical power generation.

2.0 THERMAL POWER STATIONS:
2.1 Layout of steam power stations.
2.2 Steam power cycle. Explain Carnot vapour power cycle with P-V, T-s diagram and determine thermal efficiency.
2.3 Explain Rankine cycle with P-V, T-S & H-s diagram and determine thermal efficiency, Work done, work ratio, and specific steam Consumption.
2.4 Solve Simple Problems.
2.5. List of thermal power stations in the state with their capacities.
2.6 Boiler Accessories: Operation of Air pre heater, Operation of Economiser, Operation Electrostatic precipitator and Operation of super heater. Need of boiler mountings and operation of boiler

2.7 Draught systems (Natural draught, Forced draught & balanced draught) with their advantages & disadvantages.

2.8 Steam prime movers: Advantages & disadvantages of steam turbine, Elements of steam turbine, governing of steam turbine. Performance of steam turbine: Explain Thermal efficiency, Stage efficiency and Gross efficiency.

2.9 Steam condenser: Function of condenser, Classification of condenser. function of condenser auxiliaries such as hot well, condenser extraction pump, air extraction pump, and circulating pump.

2.10 Cooling Tower: Function and types of cooling tower, and spray ponds

2.11 Selection of site for thermal power stations.

3.0 NUCLEAR POWER STATIONS:

3.1 Classify nuclear fuel (Fissile & fertile material)

3.2 Explain fusion and fission reaction.

3.3 Explain working of nuclear power plants with block diagram .

3.4 Explain the working   and construction of nuclear reactor   .

3.5 Compare the nuclear and thermal plants.

3.6 Explain the disposal of nuclear waste.

3.7 Selection of site for nuclear power stations.

3.8 List of nuclear power stations.

4.0 DIESEL ELECTRIC POWER STATIONS:

4.1 State the advantages and disadvantages of diesel electric power stations.

4.2 Explain briefly different systems of diesel electric power stations: Fuel storage and fuel supply system, Fuel injection system, Air supply system, Exhaust system, cooling system, Lubrication system, starting system, governing system.

4.3 Selection of site for diesel electric power stations.

4.4 Performance and thermal efficiency of diesel electric power stations.

5.0 HYDEL POWER STATIONS:

5.1 State advantages and disadvantages of hydroelectric power plant.

5.2 Classify and explain the general arrangement of storage type hydroelectric project and explain its operation.

5.3 Selection of site of hydel power plant.

5.4 List of hydro power stations with their capacities and number of units in the state.

5.5 Types of turbines and generation used.

5.6 Simple problems.

6.0 GAS TURBINE POWER STATIONS

6.1 Selection of site for gas turbine stations.

6.2 Fuels for gas turbine

6.3 Elements of simple gas turbine power plants

6.4 Merits, demerits and application of gas turbine power plants.

Syllabus covered up to I.A-Chapters 1,2 &3

E.LEARNING RESOURCES:			
Sl. No.	Name of Authors	Title of the Book	Name of the Publisher
1	R.K Rajput	Power Plant Engineering	Laxmi Publication
2	P.K.NAG	Power Plant Engineering	TMH
3	Nag pal G,R	Power plant Engineering	Khanna Publisher
4	P.C.SHARMA	Power Plant Engineering	S.K KATARIA &SONS

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Internal assessment	20
Maximum marks:	100	End Semester Examination:	80

RATIONALE: Composite material is the advanced engineering material and plays an important Role in design of engineering products.it is s.a valuable subject for mechanical engineer

COURSE OBJECTIVES:
At the end of the course the students will be able to:
- Understand the basic concept of composite materials
- Understand the Classification of Composites
- Understand the Mechanical Properties of Composites
- Understand the Laminates
- Understand the Joining Methods and Failure Theories.

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Introduction	15
2	Classification of Composites	8
3	Mechanical Properties of Composites	12
4	Laminates	15
5	Joining Methods and Failure Theories	10

CHAPTERS
1.0 Introduction:
1.1 Classifications of Engineering Materials, Concept of composite materials.
1.2 Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, Polymer Matrix (Thermosets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc.
1.3 Types of Reinforcements/Fibers: Role and Selection or reinforcement materials.
1.4 Types of fibers, Glass fibers, Carbon fibers, Aramid fibers , Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc.,
1.5 Mechanical properties of fibers.

2.0 Classification of Composites:
2.1Classification based on Matrix Material: Organic Matrix composites, Polymer matrix composites (PMC), Carbon matrix Composites or Carbon-Carbon Composites, Metal matrix composites (MMC), Ceramic matrix composites (CMC).
2.2 Classification based on reinforcements: Fiber Reinforced Composites, Fiber Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Composites.
2.3 Comparison with Metals, Advantages & limitations of Composites.

3.0 Mechanical Properties of Composites:
 3.1 Geometrical aspects – volume and weight fraction.
 3.2 Unidirectional continuous fiber, discontinuous fibers, Short fiber systems, woven

reinforcements – Mechanical Testing.

     3.3 Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.

4.0 Laminates:

     4.1 Plate Stiffness and Compliance, Assumptions, Strains, Stress Resultants, Computation of Stresses.

     4.2 Types of Laminates - Symmetric Laminates, Antisymmetric Laminate, Balanced Laminate, Quasi-isotropic Laminates, Cross-ply Laminate, Angle ply Laminate. Orthotropic Laminate.

     4.3 Laminate Moduli, Hydrothermal Stresses.

5.0 Joining Methods and Failure Theories:

     5.1 Joining –Advantages and disadvantages of adhesive and mechanically fastened joints.

     5.2 Typical bond strengths and test procedures.

Syllabus covered up to I.A-Chapters 1, 2 & 3

E.LEARNING RESOURCES:			
Sl. No.	*Name of Authors*	*Title of the Book*	*Name of the Publisher*
1	A.K Bhargava	Engineering Materials: Polymers, Ceramics and Composites	Prentice Hall India
2	G. Dieter	Mechanical Metallurgy	Mc-Graw Hill
3	R.F. Speyer	Thermal Analysis of Materials	Marcel Decker

TH 4b ADVANCE MANUFACTURING PROCESSES

Theory	4 Periods per week	Internal Assessment	20 Marks
Total Periods	60 Periods	End Sem Exam	80 Marks
Examination	3hours	Total Marks	100Marks

RATIONALE:

Advance manufacturing processes is the field of production by advance nontraditional methods which give the conversion of raw materials into finished product..

COURSE OBJECTIVES:

At the end of the course the students will be able to:

- Understand the working principle of modern machining processes.
- Understand the Plastic Processing
- Understand the additive manufacturing process
- Understand the Special Purpose Machines
- Understand the Maintenance of Machine Tools

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Modern Machining Processes	20
2	Plastic Processing	10
3	Additive Manufacturing Process	15
4	Special Purpose Machines	7
5	Maintenance of Machine Tools	8

DETAILED CONTENTS

1.0 Modern Machining Processes:

1.1 Introduction – comparison with traditional machining.

1.2 Ultrasonic Machining: principle, Description of equipment, applications.

1.3 Electric Discharge Machining: Principle, Description of equipment, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, applications.

1.4 Wire cut EDM: Principle, Description of equipment, controlling parameters; applications.

1.5 Abrasive Jet Machining: principle, description of equipment, Material removal rate, application.

1.5 Laser Beam Machining: principle, description of equipment, Material removal rate, application.

1.6 Electro Chemical Machining: principle, description of equipment, Material removal rate, application.

1.7 Plasma Arc Machining – principle, description of equipment, Material removal rate, Process parameters, performance characterization, Applications.

1.8 Electron Beam Machining - principle, description of equipment, Material removal rate, Process parameters, performance characterization, Applications.

2.0 Plastic Processing:

2.1 Processing of plastics.

2.2 Moulding processes: Injection moulding, Compression moulding, Transfer moulding.

2.3 Extruding; Casting; Calendering.

2.4 Fabrication methods-Sheet forming, Blow moulding, Laminating plastics (sheets, rods & tubes), Reinforcing.

2.5 Applications of Plastics.

3.0 Additive Manufacturing Process:

3.1 Introduction, Need for Additive Manufacturing

3.2 Fundamentals of Additive Manufacturing, AM Process Chain

3.3 Advantages and Limitations of AM, Commonly used Terms

3.4 Classification of AM process, Fundamental Automated Processes, Distinction between AM and CNC, other related technologies.

3.5 Application –Application in Design, Aerospace Industry, Automotive Industry, Jewelry Industry, Arts and Architecture. RP Medical and Bioengineering Applications.

3.6 Web Based Rapid Prototyping Systems.

3.7 Concept of Flexible manufacturing process, concurrent engineering, production tools like capstan and turret lathes, rapid prototyping processes.

4.0 Special Purpose Machines (SPM):

4.1 Concept, General elements of SPM, Productivity improvement by SPM, Principles of SPM design.

5.0 Maintenance of Machine Tools:

5.1 Types of maintenance, Repair cycle analysis, Repair complexity, Maintenance manual, Maintenance records, Housekeeping. Introduction to Total Productive Maintenance (TPM).

Syllabus covered up to I.A-Chapters 1,2 &3

E.LEARNING RESOURCES:			
Sl. No.	Name of Authors	Title of the Book	Name of the Publisher
1	O.P.KHANNA	Production technology –Vol-II	Dhanpat Rai Publication
2	B.S. Raghuwanshi	Workshop Technology, Vol – II	Dhanpat Rai Publication
3	HMT, Bangalore	Production Technology	Tata Mc-Graw Hill
4	1. Chua C.K., Leong K.F. and LIM C.S,	Rapid prototyping: Principles and Applications	WORLD SCIENTIFIC PUBLICATION,THIRD EDITION,2010
5	Stephen F. Krar & Arthur Gil	Exploring Advanced Manufacturing Technologies	1. Industrial Press

TH.4(c) INDUSTRIAL ROBOTICS & AUTOMATION (Elective)

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Internal assessment	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Today's manufacturing units are using robots as substitute for workers working in hazardous atmosphere. Any automation found are using robots which are known as industrial robots and helps in mass production and assembling parts to make a finished product. So to meet the need of the day this Subject should be included in the syllabus of mechanical engineering of diploma stream.
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COURSE OBJECTIVES:
At the end of the course the students will be able to:
- Understand the basic concepts, parts of robots and types of robots.
- Understand the various drive systems for robot, sensors and their applications in robots and programming of robots.
- Understand the robots according to its usage.
- Understand the various applications of robots, justification and implementation of robot.
- Conceptualize automation and understand applications of robots in various industries.

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Fundamentals of Robotics	10
2	Robotic Drive System and Controller	12
3	Sensors	8
4	Introduction to Machine Vision	10
5	Robot kinematics and Robot Programming	15
6	Automation & Industrial Applications	5

CHAPTERS
1.0 Fundamentals of Robotics:
1.1 Definition; Robot anatomy (parts) and its working.
1.2 Robot Components: Manipulator, End effectors; Construction of links, Types of joints.
1.3 Classification of robots; Cartesian, Cylindrical, Spherical, Scara, Vertical articulated.
1.4 Structural Characteristics of robots; Mechanical rigidity; Effects of structure on control work envelope and work Volume.
1.5 Robot work Volumes, comparison.
1.6 Advantages and disadvantages of robots.

2.0 Robotic Drive System and Controller:
2.1 Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives.
2.2 AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion.
2.3 Feedback devices; Potentiometers; Optical encoders; DC tachometers.

2.4 Robot controller; Level of Controller; Open loop and Closed loop controller.
2.5 Microprocessor based control system; Robot path control: Point to point, Continuous path control and Sensor based path control; Controller programming.

3.0 Sensors:
3.1 Requirements of a sensor.
3.2 Principles and Applications of the following types of sensors: Position sensors (Encoders, Resolvers, Piezo Electric); Range sensors (Triangulation Principle, Structured lighting approach).
3.3 Proximity sensing; Force and torque sensing.

4.0 Introduction to Machine Vision:
4.1 Robot vision system (scanning and digitizing image data); Image processing and analysis.
4.2 Cameras (Acquisition of images); Videocon camera (Working principle & construction).
4.3 Applications of Robot vision system: Inspection, Identification, Navigation & serving.

5.0 Robot kinematics and Robot Programming:
5.1 Forward Kinematics; Inverse Kinematics and Differences.
5.2 Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Deviations and Problems.
5.3 Teach Pendant Programming; Lead through programming; Robot programming Languages; VAL Programming.
5.4 Motion Commands; Sensor Commands; End effecter commands; and Simple programs.

6.0 Automation & Industrial Applications:
6.1 Basic elements of automated system, advanced automation functions, levels of automation.
6.2 Application of robots in machining; welding; assembly and material handling.

 Syllabus covered up to I.A-Chapters 1, 2 & 3

E.LEARNING RESOURCES:			
Sl. No.	**Name of Authors**	**Title of the Book**	**Name of the Publisher**
1	Saeed B. Niku	Introduction to Robotics: Analysis, Systems, Applications	Pearson Education Inc.New DELHI 2006
2	M.P. Groover	Industrial Robotics: Technology, Programming and Applications	Tata Mc Graw Hill Co,2001
3	Fu K S Gonzalz R Cand Lee C S G	Robotics control,sensing,visionand intelligence	1. Mc-Graw Hill Book Co, 1987.
4	Ganesh S. Hedge	A Text book on Industrial Robotics	1. , Laxmi Publications Pvt. Ltd., New Delhi
5	S.R. Deb & Sankha Deb	Robotics Technology and Flexible Automation Robot	1. Tata McGraw-Hill, 2010.

Pr.1 AUTOMOBILE ENGINEERING LAB

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Practical periods:	4 P/W	Sessional	50
Maximum marks:	100	End Semester Examination:	50

COURSE OBJECTIVES

At the end of the course the students will be able to

List of Practical .

1. Study of Automobile chassis.

2. Study the differential mechanism of the Tractor.

3. Study the hydraulic braking system of automobile.

4. Study Study the cut section model of carburetor solex type and maruti car type.

5. Study the fuel pump cut section model.

6. Study the actual cut section of gear box.

7. Study of actual car engine.

Pr 2. POWER STATION ENGINEERING LAB

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Practical periods:	4 P/W	Sessional	25
Maximum marks:	75	End Semester Examination:	50

COURSE OBJECTIVES

At the end of the course the students will be able to

List of Practical

Experiment 01-To study the modern steam power plant with model.
Experiment 02-To determine the various efficiencies of steam turbine.
Experiment 03-To study the cooling tower.
Experiment 04-Study of jet condenser.
Experiment 05-Study of De-lavel turbine.
Experiment 06-To study the spring loaded safety valve.
Experiment 07-To study the following steam generators (boilers)models.

        a) Lancashire boiler.

        b) Cornish boiler.

        c)Babcock & Wilcox Boiler.

        d)Vertical water tube boiler.

Pr3. PROJECT Phase - II

Name of the Course: Diploma in Mechanical Engineering			
Course code:		Semester	6th
Total Period:	150	Examination	3 hrs
Lab. periods:	10 P / week	Sessional	50
Maximum marks:	150	End Sem Examination	100

RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of Mechanical engineering and practices in real life situations, so as to participate and manage a large Mechanical engineering projects, in future. Entire Project spreads over 5th and 6th Semester. Part of the Project covered in 5th Semester was named as *Project Phase-I* and balance portion to be covered in 6th Semester shall be named as *Project Phase-II*.

OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop software packages or applications and implement these for the actual needs of the community/industry.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- To achieve real life experience in Project design.
- To develop the skill of writing Project Report

Project Phase-I and Phase-II

The Project work duration covers 2 semesters(5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group was done in the beginning of 5th semester under Project Phase-I. The students were allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work and Design of the system also have to be complete in Phase-I. Development may also begin in this phase. Project Milestones are to be set so that progress can be tracked .

In Phase-II Development, Testing, Documentation and Implementation have to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the components of Task and schedule.

At the end of Project Phase-II in 6th semester there shall be one presentation by each group on whole Project work undertaken by them.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	Performance Criteria
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations to such an exhibition.

The Project Report need to be prepared as per standard format and following is the indicative format. The Teacher Guide may make minor alteration keeping the sense in tact.

<div align="center">Organization of Project Report</div>

1. Cover page:
    It should contain the following (in order)
    (i)   Title of the Project
    (ii)   "Submitted in partial fulfillment of the requirements for the Diploma in <Branch Name>"
    (iii)   By Name of the Student(s)
    (iv)   Logo of the Institution
    (v)   Branch Name/Depart Name and Institution Name with Address
    (vi)   Academic Year
2. 1st Inner page
    Certificate:
    It should contain he following
    "This is to certify that the work in this Project Report entitled <Project Title> by <Name of student(s)> has been carried out under my supervision in partial fulfillment of the requirements for the Diploma in <Branch Name>" during session <session > in <Branch /Department Name> of <Institute name> and this work is the original work of the above student(s).

    Seal and signature of the Supervisor/Guide with date
3. 2nd Inner Page
    Acknowledgement by the Student(s)
4. Contents.
5. Chapter wise arrangement of Reports
6. Last Chapter: Conclusion
    It should contain
    (i)   Conclusion
    (ii)   Limitations
    (iii)   Scope for further Improvement
7. References

Pr-4 LIFE SKILL
(Common to All Branches)

Practical	2 Periods per week	Sessional	25 Marks
Total Periods	30 Periods	Total Marks	25 Marks

Objective: After completion of this course the student will be able to**:**

- Develop team spirit i.e. concept of working in team
- Apply problem solving skills for a given situation
- Use effective presentation techniques
- Apply task management techniques for given projects
- Enhance leadership traits
- Resolve conflict by appropriate method
- Survive self in today's competitive world
- Face interview without fear

DETAIL CONTENTS:
1. SOCIAL SKILL
Society, Social Structure, Develop Sympathy and Empathy
Swot Analysis – Concept, How to make use of SWOT
Inter personal Relation**:** Sources of conflict, Resolution of conflict ,
 Ways to enhance interpersonal relation

2. PROBLEM SOLVING
Steps of Problem solving**:**
- Identify and clarify the problem,
- Information gathering related to problem,
- Evaluate the evidence,
- Consider alternative solutions and their implications,
- Choose and implement the best alternative,
- Review
- Problem solving techniques:

1) Trial and error, 2) Brain storming, 3) Lateral (Out of Box) thinking

3. PRESENTATION SKILL

Body language , Dress like the audience
Posture, Gestures, Eye contact and facial expression. STAGE FRIGHT,
Voice and language – Volume, Pitch, Inflection, Speed, Pause
Pronunciation, Articulation, Language, Practice of speech.
Use of AV aids such as Laptop with LCD projector, white board etc.
4. GROUP DISCUSSION AND INTERVIEW TECHNIQUES
Group Discussion:
Introduction to group discussion, Ways to carry out group discussion,
Parameters— Contact, body language, analytical and logical thinking,
 decision making
Interview Technique :
Dress, Posture, Gestures, facial expression, Approach
Tips for handling common questions.

5. WORKING IN TEAM
Understand and work within the dynamics of a groups.
Tips to work effectively in teams,
Establish good rapport, interest with others and work effectively with them
 to meet common objectives,
Tips to provide and accept feedback in a constructive and considerate way ,
Leadership in teams, Handling frustrations in group.
6. TASK MANAGEMENT
Introduction, Task identification, Task planning ,
 organizing and execution, Closing the task

PRACTICAL

List of Assignment: *(Any Five to be performed including Mock Interview)*

1. **SWOT analysis:-**
    Analyse yourself with respect to your strength and weaknesses, opportunities and threats. Following points will be useful for doing SWOT.
a) Your past experiences,
b) Achievements,
c) Failures,
d) Feedback from others etc.

2. **Solve the True life problem assigned by the Teacher.**

3. **Working in a Team**
 Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, environment protection, camps on awareness like importance of cleanliness in slum area, social activities like giving cloths to poor etc.(One activity per group where Team work shall be exhibited)

4. **Mock Interview**

5. **Discuss a topic in a group and prepare minutes of discussion.**

6. **Deliver a seminar for 5 minutes using presentation aids on the topic given by your teacher.**

7. **Task Management**
Decide any task to be completed in a stipulated time with the help of teacher. Write a report considering various steps in task management (with Break up into sub tasks and their interdependencies and Time)

Note: -1. Please note that these are the suggested assignments on given contents/topic. These assignments are the guide lines to the subject teachers. However the subject teachers are free to design any assignment relevant to the topic.

Note: -2. The following Topics may be considered for Seminar/GD in addition to other Topics at the discretion of the Teacher.
(Comparison with developed countries, Occupational Safety, Health Hazard, Accident & Safety, First-Aid, Traffic Rules, Global Warming, Pollution, Environment, Labour Welfare Legislation, Labour Welfare Acts, Child Labour Issues, Gender Sensitisation ,Harassment of Women at Workplace)

METHODOLOGY:

 The Teacher is to explain the concepts prescribed in the contents of the syllabus and then assign different Exercises under Practical to the students to perform.

Books Recommended:-

Sl.No	Name of Authors	Title of the Book	Name of the Publisher
01	E.H. Mc Grath , S.J	Basic Managerial Skills for All	PHI
02	Lowe and Phil	Creativity and problem solving	Kogan Page (I) P Ltd
03	Adair, J	Decision making & Problem Solving	Orient Longman
04	Bishop , Sue	Develop Your Assertiveness	Kogan Page India
05	Allen Pease	Body Language	Sudha Publications Pvt. Ltd.

EQUIPMENT LIST

AUTOMOBILE ENGINEERING LAB

SL.NO	NAME OF THE EQUIPMENTS	QUANTITY
01	Chassis of a car	01 no
02	Differential of a Tractor	01 no
03	Hydraulic brake system of a car working model	01 no
04	Solex carburetor	01 no
05	Maruty car type carburetor	01 no
06	Cut section of a fuel pump	01no
07	New car engine	01 no
08	Gear box	01no

POWER STATION ENGINEERING LAB

SL.NO	NAME OF THE EQUIPMENTS	QUANTITY
01	Stainless steel steam turbine test rig 01Kw 3000RPM	01no
02	Cooling Tower Apparatus or model	01no
03	Jet Condenser apparatus or model	01no
04	De Lavel turbine	01no
05	Spring loaded safety valve	02nos
06	Lancashire boiler model	01no
07	Babcock and Wilcox boiler model	01nos
08	Cornish boiler model	01no
09	Vertical water steam boiler model	01no